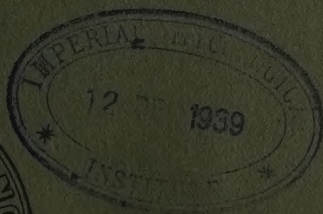
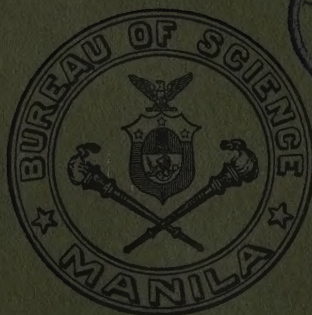


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THE FLEAS OF CHINA¹

ORDER SIPHONAPTERA

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ONE HUNDRED AND THIRTY-TWO TEXT FIGURES

INTRODUCTION

Until the discovery of their rôle in the transmission of plague from rodents to man, the fleas were a neglected group of insects. The establishment of this relationship between man, rat, and flea was chiefly responsible for the intensification of the systematic and other lines of investigation on this small group of insects.

About 800 species are known from different parts of the world. Jordan (1928) reported that 46 species are known from England and 131 species from the United States. In a previous paper (1936) I have compiled another 70 species for China.

In the present paper attempts have been made to summarize our knowledge of the Chinese Siphonaptera to date and to bring together their descriptions. I have thus included keys to families, subfamilies, genera, and species, as well as descriptions of salient characters. For a detailed bibliography and specific distribution of Chinese fleas the reader is referred to the catalogue mentioned above. In this catalogue are mentioned 7 subfamilies

¹ Contribution No. 7 from the Division of Entomology, College of Agriculture, National University of Chekiang, Hangchow.

² Chinese form: Liu Chi-ying.

belonging to 3 families. Owing to our increased knowledge of the group at present, it seems necessary to raise some subfamilies to family rank. Besides, there are a few additional species, and minor changes had to be made in the arrangement of some groups. Many of the illustrations included in this paper are adapted from the original authorities, and for economy of space the proportional distance between the spermatheca and the seventh sternite shown in the figure is often shortened.

The present study was begun in 1933 at the suggestion of Dr. Wm. A. Riley, Chief of the Division of Entomology and Economic Zoölogy, University of Minnesota, to whom I am indebted for helpful criticisms, much assistance, and constant encouragement throughout the progress of this work. Thanks are due Dr. H. E. Ewing, of the United States National Museum; to Dr. K. Jordan, of the Tring Zoölogical Museum; to Dr. J. Wagner, of the University of Belgrade; to Dr. I. Ioff, of the Microbiological Institute, Voroshilovsk; to Dr. Y. C. Hsü, of Yenching University; to Mr. F. S. Lee, now of the National Cotton Improvement Institute, and to Miss M. Y. Wu at Wuchang, for their kindness in loaning or supplying material for study. Several institutions, particularly Cornell University, Harvard University, and the University of Oklahoma, loaned specimens for study, and a number of persons, particularly Dr. C. E. Mickel, Mrs. M. C. Priestersbach, and Dr. C. H. Yen, all of the University of Minnesota; Dr. C. H. Hoffmann, now of the Bureau of Entomology and Plant Quarantine; Mr. K. F. Chen, of the University of Nanking; and Mr. M. H. Feng, of the West Lake Provincial Museum, aided me in various ways, and it is a pleasure to acknowledge here their generous help and hearty coöperation.

HISTORY

The history of the Siphonaptera, taxonomically speaking, begins with the description of the cosmopolitan human flea, *Pulex irritans*, by Linnaeus in his classical work, *Systema Naturae*.³ The first Chinese species reported was a sand flea, recorded in 1894 by Blandford, who doubtfully identified it as *Tunga penetrans*; this species was later found by Jordan and Rothschild to be a different species, named in 1921 *Tunga cæcigena*. In 1910 Dampf described *Nycteridopsylla galba*, an interesting bat flea from Shanghai. The following year, 1911, was marked by

³ Ed. 10 No. 1 (1750) 614.

a large crop of Chinese forms described by Jordan and Rothschild. In 1912 Rothschild discovered, besides two other species, a jigger flea, *Vermipsylla dorcadia*, the females of which are sedentary maggotlike creatures parasitic in the roe deer's nostrils, and the males lead an active life in the thick coat of the same animal. Little was done between 1913 and 1920, while the period from 1921 to the present has been one of great activity in the study of this group. The untimely death of the Honorable N. C. Rothschild in 1923 was undoubtedly a great loss to science in this field. Most of the Chinese forms were later discovered by Dr. Karl Jordan and to a lesser extent by Dr. Julius Wagner, both of these workers being leading world authorities on this order of insects. Dr. H. M. Jettmar's collection of Siphonaptera from Mongolia and Manchuria, and Mr. H. Stevens's collection on the Kelley-Roosevelt Expedition in Yunnan and Szechuan yielded a number of new genera and species and contributed much to our knowledge of the fleas of northern and western China. Up to the present 73 species have been described or recorded from China, distributed in 6 families, 8 subfamilies, and 29 genera (Table 1).

In Table 2 a complete list of the 73 species of Chinese fleas is given together with the collections in which the types of each species are deposited. Two new species and one new genus are included.

TAXONOMIC CHARACTERS

Head.—The head is divided by the antennal groove into an anterior and a posterior portion, known as the front and occiput, respectively. The lateral lower portion of the front beneath the eye is the gena, and its prolongation backwards, the genal process. The antennal groove is said to be closed if this genal process extends so far back as to meet the occiput, or open if it is short and widely separated from the occiput. The frontal margin may be entire or notched, forming the frontal tubercle. The eye may be present, absent, or rudimentary. The antenna at rest lies in the antennal groove, the dorsum or venter of which may be open or closed. It consists of three parts, the first segment (scape), the second segment (pedicel) and the distal part (club). The pedicel usually bears a number of bristles which may or may not extend beyond the club. The club is composed of nine segments, the degree of this segmentation being of taxonomic value as some

TABLE 1.—Describers of Chinese fleas and species described.

[illegible]

[illegible]

TABLE 2.—List of Chinese species of fleas and collections in which they are deposited.

Group.	Type collection.
1. Family Ceratophyllidæ Dampf, 1908.	
Subfamily Ceratophyllinæ Dampf, 1908.	
1. Genus <i>Ceratophyllus</i> Curtis, 1832 (<i>sensu lato</i>).	
1. (<i>Ceratophyllus</i>) <i>gallinæ</i> (Schränk), ? 1803	
2. (<i>Ceratophyllus</i>) <i>sinicus</i> Jordan, 1932	Zool. Mus. Tring ^a
3. (<i>Monopsyllus</i>) <i>anisus</i> Rothschild, 1907	Do.
4. (<i>Nosopsyllus</i>) <i>fasciatus</i> (Bosc), 1801 ?	
5. (<i>Gerbillophilus</i>) <i>læviceps ellobii</i> Wagner, 1929.	Zool. Mus. USSR ^b
6. (<i>Callopsylla</i>) <i>kozlovi</i> Wagner, 1929	Do.
7. (<i>Callopsylla</i>) <i>dolabris</i> Jordan et Rothschild, 1911.	Zool. Mus. Tring
8. (<i>Callopsylla</i>) <i>kaznakovi</i> Wagner, 1929	Zool. Mus. USSR
9a. (<i>Citellophilus</i>) <i>tesquorum mongolicus</i> Jordan et Rothschild, 1911.	Zool. Mus. Tring
9b. (<i>Citellophilus</i>) <i>tesquorum sungaris</i> Jordan, 1929.	Do.
9c. (<i>Citellophilus</i>) <i>tesquorum famulus</i> Jordan et Rothschild, 1911.	Do.
10. (?) <i>phæopis</i> Jordan et Rothschild, 1911.	Do.
11. (?) <i>sparsilis</i> Jordan et Rothschild, 1922.	Do.
2. Genus <i>Diamanus</i> Jordan, 1933.	
12. <i>mandarinus</i> (Jordan et Rothschild), 1911.	Do.
13. <i>montanus</i> (Baker), 1895	U. S. Nat. Mus. ^c
3. Genus <i>Oropsylla</i> Wagner et Ioff, 1926.	
14a. <i>silantiewi silantiewi</i> (Wagner), 1898	Wagner Coll. (?)
14b. <i>silantiewi crassus</i> (Jordan et Rothschild), 1911.	Zool. Mus. Tring
15. <i>elana</i> Jordan, 1929	Do.
4. Genus <i>Amphalius</i> Jordan, 1933.	
16. <i>runatus</i> (Jordan et Rothschild), 1923	Do.
17. <i>clarus</i> (Jordan et Rothschild), 1922	Do.
5. Genus <i>Paraceras</i> Wagner, 1916.	
18. <i>crispus</i> (Jordan et Rothschild), 1911	Zool. Mus. Tring
19. <i>sinensis</i> (Liu), 1935	U. S. Nat. Mus.
6. Genus <i>Neoceratophyllus</i> gen. nov.	
20. <i>trispinosus</i> sp. nov.	Liu Coll. ^d

^a England.^b Academy of Sciences, Leningrad, USSR.^c Washington, D. C.^d Division of Entomology, National University of Chekiang, Hangchow.

TABLE 2.—List of Chinese species of fleas and collections in which they are deposited—Continued.

Group.	Type collection.
7. Genus <i>Aceratophyllus</i> Ewing, 1929.	
21. <i>euteles</i> (Jordan et Rothschild), 1911	Zool. Mus. Tring
8. Genus <i>Paradoxopsyllus</i> Miyajima et Koidsumi, 1909.	
22. <i>curvispinus</i> Miyajima et Koidsumi, 1909.	?
23. <i>custodis</i> Jordan, 1932	Zool. Mus. Tring
24. <i>conveniensi</i> Wagner, 1929	Zool. Mus. USSR
9. Genus <i>Ophthalmopsylla</i> Wagner et Ioff, 1926.	
25. <i>præfectus pernix</i> Jordan, 1929	Zool. Mus. Tring
26. <i>kukuschkini</i> Ioff, 1927	Zool. Mus. USSR
27. <i>jettmari</i> Jordan, 1929	Zool. Mus. Tring
28. <i>kiritschenkoi</i> Wagner, 1929	Zool. Mus. USSR
10. Genus <i>Frontopsylla</i> Wagner et Ioff, 1926.	
29. <i>elata botis</i> Jordan, 1929	Zool. Mus. Tring
30a. <i>luculenta luculenta</i> (Jordan et Rothschild), 1923.	Do.
30b. <i>luculenta parilis</i> Jordan, 1929	Do.
31. <i>wagneri</i> Ioff, 1927	Zool. Mus. USSR
32. <i>hetera</i> Wagner, 1932	?
33a. <i>spadix spadix</i> (Jordan et Rothschild), 1921.	Zool. Mus. Tring
33b. <i>spadix cansa</i> Jordan, 1932	Do.
11. Genus <i>Geusibia</i> Jordan, 1932.	
34. <i>torosa</i> Jordan, 1932	Do.
12. Genus <i>Amphipsylla</i> Wagner, 1908.	
35. <i>tuta</i> Wagner, 1929	Zool. Mus. USSR
36. <i>aspalacis</i> Jordan, 1929	Zool. Mus. Tring
37. <i>casis</i> Jordan et Rothschild, 1911	Do.
38. <i>mitis</i> Jordan, 1929	Do.
39. <i>vinogradovi</i> Ioff, 1927	Zool. Mus. USSR
Subfamily Ctenophthalminæ Rothschild, 1915.	
13. Genus <i>Ctenophthalmus</i> Kolenati, 1857.	
40. <i>parvus</i> Jordan, 1932	Zool. Mus. Tring
41. <i>yunnanus</i> Jordan, 1932	Do.
42. <i>dinormus</i> Jordan, 1932	Do.
Subfamily Rhadinopsyllinæ Wagner, 1930.	
14. Genus <i>Stenischia</i> Jordan, 1932.	
43. <i>mirabilis</i> Jordan, 1932	Do.
15. Genus <i>Rectofrontia</i> Wagner et Argypulo, 1934.	
44. <i>dahurica</i> (Jordan et Rothschild), 1923.	Do.
45. <i>tenella</i> (Jordan), 1929	Do.
46. <i>dives</i> (Jordan), 1929	Do.

TABLE 2.—List of Chinese species of fleas and collections in which they are deposited—Continued.

Group.	Type collection.
47. <i>jaonis</i> (Jordan), 1929	Zool. Mus. Tring
48. <i>insolita</i> (Jordan), 1929	Do.
49. <i>accola</i> (Wagner), 1929	Zool. Mus. USSR
50. <i>vicina</i> (Wagner), 1929	Do.
2. Family Ctenopsyllidæ Baker, 1905.	
Subfamily Ctenopsyllinæ Wagner, 1927.	
16. Genus <i>Stenoponia</i> Jordan et Rothschild, 1911.	
51. <i>cælestis</i> Jordan et Rothschild, 1911	Zool. Mus. Tring
17. Genus <i>Palæopsylla</i> Wagner, 1902.	Do.
52. <i>remota</i> Jordan, 1929	Do.
18. Genus <i>Ctenopsyllus</i> Kolenati, 1863.	
53. <i>segnis</i> (Schönherr), 1811	?
19. Genus <i>Pectinoctenus</i> Wagner, 1929.	
54. <i>adalis</i> Jordan, 1929	Zool. Mus. Tring
Subfamily Neopsyllinæ Oudemans, 1909.	
20. Genus <i>Neopsylla</i> Wagner, 1902.	
55. <i>bidentatiformis</i> (Wagner), 1893	Wagner Coll. (?)
56. <i>anoma</i> Rothschild, 1912	Zool. Mus. Tring
57. <i>aliena</i> Jordan et Rothschild, 1911	Do.
58. <i>compar</i> Jordan et Rothschild, 1911	Do.
59. <i>stevensi</i> Rothschild, 1915	Do.
60. <i>specialis</i> Jordan, 1932	Do.
61. <i>honora</i> Jordan, 1932	Do.
3. Family Ischnopsyllidæ Wahlgren, 1907.	
21. Genus <i>Ischnopsyllus</i> Westwood, 1833.	
62. <i>comans</i> Jordan et Rothschild, 1921	Do.
63. <i>needhamia</i> Hsü, 1935	Hsü Coll.*
64. <i>tateishii</i> Sugimoto, 1933	Sugimoto Coll.†
22. Genus <i>Myodopsylla</i> Jordan et Rothschild, 1911.	
65. <i>trisellis</i> Jordan, 1929	Zool. Mus. Tring
23. Genus <i>Nycteridopsylla</i> Oudemans, 1906.	
66. <i>galba</i> Dampf, 1910	Königsberg Mus.‡ or Dampf Coll.
4. Family Vermipsyllidæ Wagner, 1889.	
24. Genus <i>Chætopsylla</i> Kohaut, 1903.	
67. <i>hangchowensis</i> sp. nov.	Liu Coll.
25. Genus <i>Vermipsylla</i> Schimkewitsch, 1885.	
68. <i>dorcadia</i> Rothschild, 1912	Zool. Mus. Tring

* Y. C. Hsü Collection, Bureau of Entomology, Hangchow.

† Veterinary Laboratory, Taihoku Imperial University, Formosa.

‡ Königsberg, Prussia.

TABLE 2.—List of Chinese species of fleas and collections in which they are deposited—Continued.

Group.	Type collection.
5. Family Pulicidæ Taschenberg, 1880.	
Subfamily Pulicinæ Tiraboschi, 1904.	
26. Genus <i>Ctenocephalides</i> Stiles et Collins, 1930.	
69. <i>canis</i> (Curtis), 1826	?
70. <i>felis</i> (Bouche), 1835	?
27. Genus <i>Archæopsylla</i> Dampf, 1908.	
71. <i>sinensis</i> Jordan et Rothschild, 1911	Zool. Mus. Tring
28. Genus <i>Xenopsylla</i> Glinkewicz, 1907.	
72. <i>cheopis</i> (Rothschild), 1903	Do.
29. Genus <i>Pulex</i> Linnæus, 1758.	
73. <i>irritans</i> Linnæus, 1758	Linnæan Society ^a
6. Family Hectopsyllidæ Baker, 1904.	
Subfamily Echidnophaginæ Wagner, 1927.	
30. Genus <i>Echidnophaga</i> Oliff, 1886.	
74. <i>gallinacea</i> (Westwood), 1875	?
Subfamily Sarcopsyllinæ Wagner, 1927.	
31. Genus <i>Dermatophilus</i> Guerin, 1838.	
75. <i>cæcigena</i> (Jordan et Rothschild), 1921	Zool. Mus. Tring

^a London, England.

species have their club partially segmented only on the posterior border instead of completely segmented all the way around. In a number of genera the gena bears a genal comb of spines arranged either horizontally or vertically. Occasionally the anterior end of the head is provided on each side with a pair of anteroventral (oral) flaps which are in reality modified genal spines. Setæ are present on the head in definite rows which are named according to their site, such as frontal row, prefrontal row, ocular row, and occipital rows. The maxillæ, as a rule, are triangular, with an acute apex. The length and the number of joints of the labial palpus are diagnostic of genera.

Thorax.—The pro-, meso-, and metathorax are formed of a dorsal portion (notum) and a ventral portion (sternum). In many genera the pronotum bears a pronotal comb. The prosternum is undivided, but the lateral portions of the meso- and metasterna are divided by an internal, rodlike, sclerotized thickening extending upward from the insertion of the coxa, into an anterior and a posterior part, the sternal and the meral portion (epimeron). The sternal portion is further divided into an upper part, the episternum, and a lower part, the sternum. The epimeron of the metathorax is broad, overlap-

ping the abdomen and supplanting the sternite of the first abdominal segment. There is a spiracle on both sides of each thoracic segment, the third being located at the upper edge of the metepimeron. In general the thorax is well developed, but in a few cases it is greatly reduced. Setæ are usually present in rows on the notum and metepimeron. The three pairs of legs are rather specialized. The coxa is a broad plate with or without spinelets and longish hairs. The presence or absence of hairs on the inner and outer surfaces of the femur are also important in classification. The tibia widens out at its distal

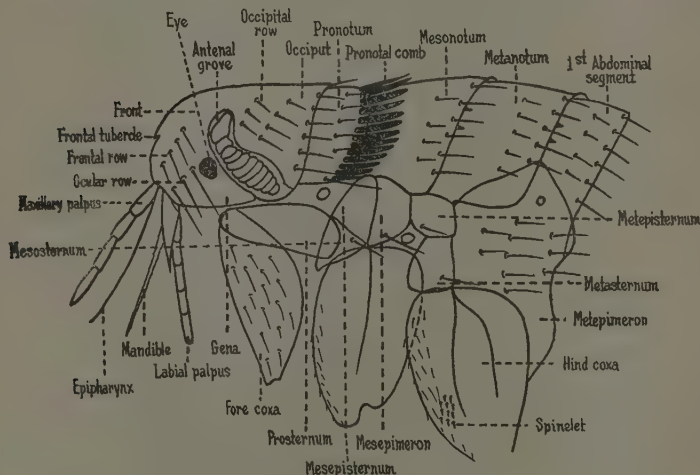


FIG. 1. Head and thorax of a flea.

extremity, and its strong bristles along the dorsum may be in a comb, rows, pairs, or even triples. The last tarsal segments are provided with lateral pairs of plantar bristles, the number and arrangement of which are of taxonomic value. Some fleas have the first pair of plantar bristles moved ventrad in between the second pair, while others do not.

Abdomen.—The abdomen bears ten segments. Spiracles are present in the pleural membrane on each side of the second to the seventh abdominal segments. The abdominal segments are clothed with setæ or bristles and sometimes have small apical teeth and combs of spines. The first abdominal sternite is always missing.

Modified segments.—The seventh tergite bears on or near its dorsoapical margin on each side one or more stout antepygidial bristles, *ant b*, sometimes arising from a conelike process. Behind these bristles is a sensory organ, known as the pygidium, *pyg*, which is carried on the dorsal portion of the ninth tergite, and separated from the seventh tergite by the dorsal part of the eighth tergite which contains the eighth or last spiracle. The size of the spiracle (stigma), particularly that of the eighth abdominal tergite and of the metathorax, is useful in the differentiation of certain genera.

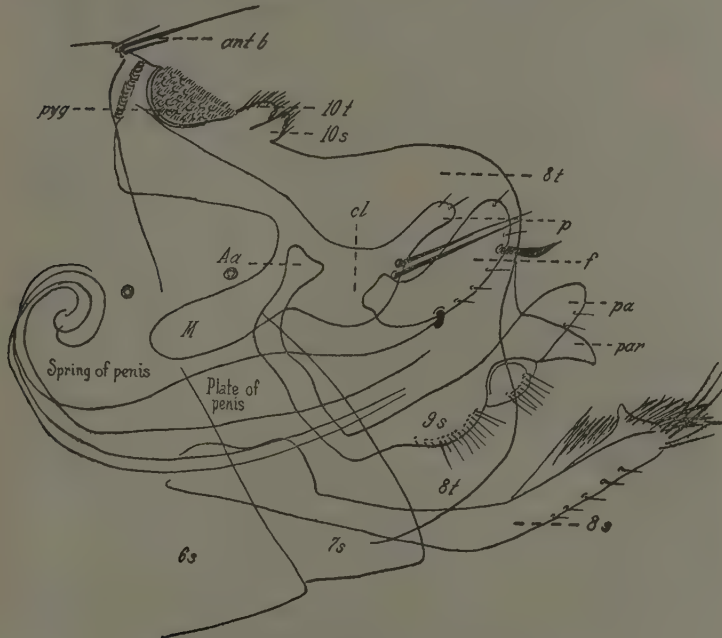


FIG. 2. Modified segments of a male flea.

Male.—The eighth tergite, *8t*, is a broad plate which conceals the ninth segment. The eighth sternite, *8s*, is usually rodlike and sometimes bears a membranous flap. The structure of the claspering organs is a matter of much concern in describing species. The claspering organs are evolved from the ninth abdominal segment and are divided into the upper and lower claspers. In general the upper claspers, which are developed

from the ninth tergite, comprise three parts: a more or less broad, irregularly shaped plate or body of the clasper *cl*, a long process extending cephaloventrad and known as the manubrium, *m*, and a pair of movable fingers or exopodites, *f*, each articulated to the plate. In some species there may be two or more movable fingers on each side. Above and anterior to the insertion of the movable finger, the body of the clasper may be prolonged to form one, and sometimes two, conelike processes, *p*. At or near the point of insertion of the finger there are usually two stout acetabular bristles. The lower clasper, *9s*, which is derived from the ninth sternite, frequently appears as a boomerang on side view. It consists of an internal anterior arm (vertical arm), *Aa*, and an external posterior arm (horizontal arm), *pa*. The former extends upward to the base of the manubrium lying on its outer side and exhibits different degrees of curvature, and the latter may project distally from the end of the abdomen and is sometimes divided into lobes or fused with its fellow of the opposite side. During the act of copulation the penis is protruded between the upper and lower claspers. The ceiling of the spring of the penis may be incomplete, complete, or double. The paramere, *par*, of the penis is usually membranous. Posterior to the pygidium are two bristled structures known as the tenth tergite, *10t*, and tenth sternite, *10s* (anal tergite or sternite).

Female.—The apex of the seventh sternite, *7s*, is characteristic of the species and is therefore of great taxonomic value. The eighth tergite, *8t*, is a broad plate, its lateral portion expanding to form a broad lobe which conceals the ninth tergite and the ninth sternite between which the vulva is located. The eighth sternite, *8s*, is usually an elongated arm situated ventrad between the seventh sternite and the eighth tergite. The tenth tergite, *10t*, and the tenth sternite, *10s*, appear as two small flaps posterior to the pygidium. The tenth tergite bears a small bristled process known as the stylet, *sty*. The anus in both sexes is located between the tenth tergite and the tenth sternite. Some accessory reproductive organs are almost as valuable in the determination of species in the female as the claspers are in the male. This is especially true of the spermatheca (receptaculum seminis), the bursa copulatrix, and the accessory ducts. The spermatheca, *sp*, is made up of a dilated portion or head (body) and a contracted portion or tail (appendix). Attached to the apex of the head is the tortuous coil of the duct of the

spermatheca (ductus receptaculi seminis). Its distal part, which is connected with the head, is in some species dilated and known as pars dilatata, and its proximal part empties into the bursa copulatrix which receives the penis during copulation. The bursa copulatrix is usually divided into three parts, a dilated upper part, a middle part usually more sclerotized than the rest, and a lower part or duct. The upper part is connected to the duct of the spermatheca on the one hand, and is sometimes connected to a blind duct known as ductus obturatorius on the other hand. The spermatheca and part of the bursa copulatrix are more or less sclerotized and are therefore easily recognized. The ducts are, however, more difficult to see and study.

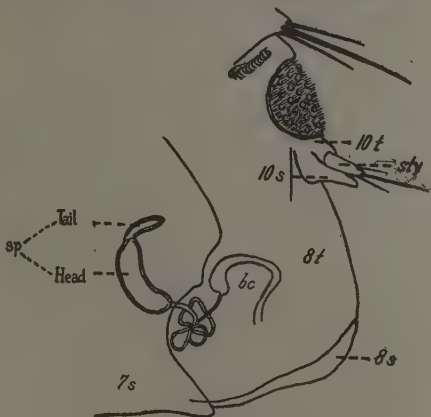


FIG. 3. Modified segments of a female flea.

Order SIPHONAPTERA

Small, wingless, laterally compressed insects, usually with dark-colored, bristly body and legs, heavily sclerotized; ectoparasitic in the adult stage on mammals, or occasionally on birds. Head small, closely articulated with thorax. Antennæ short and thick, with two large basal joints and an oval or elongate apical portion reposing in grooves. Eyes present or absent. Mouth parts fitted or piercing and sucking, mandibles setiform, maxillæ bladelike; both pairs of palpi well developed. Thorax small, composed of three freely movable segments. Legs large, stout; coxæ very large, tarsi 5-jointed, with stout claws. Abdomen large, composed of ten segments. Metamorphosis complete; larvæ elongate, cylindrical, legless, with well-developed head and biting mouth parts; free living. Pupæ enclosed in cocoons. (Modified from Brues and Melander, 1932).

Key to the families of Siphonaptera.

1. Thorax not reduced, three thoracic tergites together longer than first abdominal tergite. Abdomen of gravid female only slightly, if at all, distended 2.

Thorax considerably reduced, three thoracic tergites together shorter than first abdominal tergite. Abdomen of gravid female greatly distended.

HECTOPSYLLIDÆ.

2. Clasper of male with one movable finger on each side. Hind coxæ usually without spinelets on inner side. Typical abdominal tergites usually with at least two rows of setæ..... 3.

Clasper of male with two movable fingers on each side. Hind coxæ with spinelets on inner side. Typical abdominal tergites with but a single row of setæ PULICIDÆ.

3. With or without comb, in latter case antepygial bristles always present in both sexes. Abdominal tergites provided with tiny apical teeth..... 4.
With neither comb nor antepygial bristles. Abdominal tergites without tiny apical teeth..... VERMIPSYLLIDÆ.

4. Vertical suture between bases of antennal grooves absent or rudimentary. Abdomen without combs. Head without preoral flaps. Abdomen of female with only one spermatheca..... CERATOPHYLLIDÆ.

Vertical suture between bases of antennal grooves distinctly present. Abdomen sometimes with combs. Head sometimes with preoral flaps. Abdomen of female often with two spermathecae..... 5.

5. Head without two preoral flaps on each side. Mainly on rodents, not on bats CTENOPSYLLIDÆ.

Head with two preoral flaps on each side. On bats..... ISCHNOPSYLLIDÆ.

1. Family CERATOPHYLLIDÆ Dampf, 1908

Head with or without genal comb. Eyes present or absent. Vertical suture between bases of antennal grooves absent or rudimentary. Preoral flaps lacking. Thorax not strongly shortened, its tergites together longer than first abdominal tergite. Pronotal comb often present. Abdomen without combs, with tiny apical teeth on some tergites, with more than a single row of bristles to each typical abdominal tergite. Antepygial bristles present in both sexes. Clasper of male with one movable finger. Abdomen of gravid female only slightly distended, provided with only one spermatheca. The largest family of the order Siphonaptera.

Key to the subfamilies of Ceratophyllidæ.

1. Head without genal comb..... CERATOPHYLLINÆ.
Head with genal comb 2.
2. Genal comb horizontal, composed of three nearly equal spines. Both sexes with antepygial bristles..... CTENOPHTHALMINÆ.
Genal comb obliquely vertical, composed of four to six spines. Male with antepygial bristles..... RHADINOPSYLLINÆ.

Subfamily CERATOPHYLLINÆ Dampf, 1908

Head without genal comb, with a frontal tubercle. Eyes present or absent. Antennal groove usually widely open in both

sexes. As a rule, antepygidial bristles present in both sexes; females in general with three large antepygidial bristles, males with one large antepygidial bristle on each side.

Key to the genera of Ceratophyllinæ.

1. Ocular bristle situated below upper margin of eye and in front of eye.
Front without internal sclerotized rod before eye..... 2.
Ocular bristle situated above upper margin of eye and near margin of antennal groove. Front with internal sclerotized rod before eye, its anterior apex located near midbristle of ocular row and winding upwards, disappearing at eye, and terminating at apex of genal process 8.
2. First pair of plantar bristles shifted ventrad and located almost in between second pair. Finger of male with ventral process near base.... 3.
First pair of plantar bristles not, or only slightly, shifted ventrad, not located in between second pair..... 4.
3. Inner surface of mid- and hind coxæ without longish thin bristles from base to apex. Fore femur with lateral bristle on outer surface. *It* not projecting medianly in between two sets of antepygidial bristles. Male, finger with one ventral process. Ejaculatory duct normal. Female, stylet with one bristle at apex. Division between head and tail of spermatheca distinct..... *Aceratophyllus* Ewing.
- Inner surface of mid- and hind coxæ with longish thin bristles from base to apex. Fore femur with several small lateral bristles on outer surface. *It* slightly projecting medianly in between two sets of antepygidial bristles. Male, finger with two ventral processes. Ejaculatory duct deeply curved twice. Female, stylet with numerous bristles at rounded apex. Division between head and tail not distinct.
Amphalius Jordan.
4. Inner surface of mid- and hind coxæ without longish thin bristles. *It* with a short median process in between two sets of antepygidial bristles *Neoceratophyllus* gen. nov.
- Inner surface of mid- and hind coxæ with longish thin bristles. *It* as a rule without median process in between two sets of antepygidial bristles 5.
5. Inner surface of mid- and hind coxæ with longish thin bristles from base to apex. Labial palpus reaching to, or beyond, apex of fore trochanter 6.
- Inner surface of mid- and hind coxæ with longish thin bristles at most in apical half. If bristles are present on basal half, the hind part of 8t of male is widened to form a dorsal projection and the anal sternite is longitudinally split into two lobes and is much longer than the anal tergite. Labial palpus, except in the subgenus *Citellophilus* and in the section *Gerbilophilus*, reaching, or not reaching, to apex of forecoxa..... *Ceratophyllus* Curtis. (*sensu lato*).
6. Outer surface of fore femur usually without lateral bristles. Male, bristles of second antennal segment reaching beyond apex of club. Three antepygidial bristles all spinelike, two outer ones much shorter. 8t with dorsal spiculate area on inner side. Female with three antepygidial bristles. Stylet with one lateral bristle..... *Paraceras* Wagner.

Outer surface of fore femur with few lateral bristles. Male, bristles of second antennal segment not reaching to one-third of club. One antepygidial bristle as a rule, upper one minute, lower one minute or wanting. 8t without dorsal spiculate area on inner side. Female with two to three antepygidial bristles. Stylet with two to five lateral bristles 7.

7. Male, 8s narrow, with apical bristles, but without membranous flap. Finger claviform. Female, three antepygidial bristles (sometimes two to five). Stylet with two to five lateral bristles.

Oropsylla Wagner et Ioff.

Male, 8s small or rudimentary. Finger swordlike. Female, two antepygidial bristles. Stylet with dorsal lateral bristle smaller than ventral *Diamanus* Jordan.

8. First pair of plantar bristles of fifth tarsal segment shifted ventrad and situated between second pair. Eye almost rudimentary or lacking. Hind tibia, in addition to usual spines, with an apical comb row of three or four short and equal spines. Male clasper without acetabular bristles..... *Amphipsylla* Wagner.

First pair of plantar bristles of fifth tarsal segment not shifted ventrad; if so, not situated between second pair. Eyes developed, often divided into two parts, upper light-colored, lower dark. Hind tibia without apical comb row. Male clasper with one or two acetabular bristles. 9.

9. Antepygidial bristles present in both sexes. 7t without median process. 8t dorsolaterally without elongate, horizontal sclerite bearing a condylus 10.

Antepygidial bristles none in male, three in female. 7t with median process reaching to middle of pygidium in male and shorter in female. 8t dorsolaterally with an elongate, horizontal sclerite bearing a condylus *Geusibia* Jordan.

10. Eye peculiarly divided into an upper lightly pigmented and a lower deeply pigmented part which appears as a second eye. All three antepygidial bristles in male spinelike. Clasper with acetabular projection bearing a single acetabular bristle.

Ophthalmopsylla Wagner et Ioff.

Eye normal. One or sometimes both of outer two of three antepygidial bristles in male minute or wanting. Clasper often without acetabular projection, but bearing one or two acetabular bristles..... 11.

11. Occiput with two rows of bristles (excluding apical row). Frontal tubercle conical. Male, clasper with two acetabular bristles. 8t longitudinally divided into two lobes. Female, division between head and tail of spermatheca not distinct..... *Frontopsylla* Wagner et Ioff.

Occiput with one rudimentary row of bristles as a rule. Frontal tubercle small or wanting. Male, clasper with one, scarcely two, acetabular bristles. 8t not longitudinally divided into two lobes. Female, division between head and tail distinct.

Paradoxopsyllus Miyajima et Koidsumi.

1. Genus CERATOPHYLLUS Curtis, 1832 (sensu lato)

Labial palpus reaching to apex of forecoxa in most cases, but in subgenus *Citellophilus* extending beyond apex of fore tro-

chanter. Ocular bristle situated lower than upper margin of eye. Bristles of second antennal segment in male never projecting beyond apex of club. One frontal row of none to seven bristles in female (except in subgenus *Pleochætis* in which one or two rows may be present). Inner surface of mid- and hind coxæ with longish thin bristles at most in apical half; if bristles are present on basal half, posterior portion of 8t of female widened to form a process at top and anal sternite longitudinally split into two lobes and much longer than anal tergite. Outer surface of fore femur with a number of small lateral bristles. Longest bristle of second hind tarsal segment often not reaching beyond apex of fourth. First pair of plantar bristles of fifth tarsal segment situated as laterally as are other pairs or only slightly moved ventrad. Male, one or both of the outer two of three antepygial bristles minute or wanting. 8s, except in subgenus *Nosopsyllus*, well developed. Finger of various forms. Ejaculatory duct normal. Female, two or three antepygial bristles. Stylet with one apical bristle, and one to three lateral bristles.

The old genus *Ceratophyllus* has for years been the most puzzling group of Siphonaptera. A few years ago it was broken up into a number of genera by Wagner (1927, 1934) and Jordan (1933). Recently Ioff (1936) studied the subfamily Ceratophyllinæ and, as a result, suppressed some of Jordan's and Wagner's genera as subgenera of *Ceratophyllus* (*sensu lato*).

Key to the subgenera of Ceratophyllus (sensu lato).

1. Male, 8s rudimentary. Two antepygial bristles, upper bristle short but stout, lower rudimentary. Female, bursa copulatrix rolled up as a spiral..... *Nosopsyllus* Jordan (*sensu lato*) 2.
Male, 8s developed. Usually one antepygial bristle, outer two either rudimentary or of unstable stoutness. Female, bursa copulatrix not rolled up as a spiral 3.
2. Longest apical bristle of second hind tarsal segment extending beyond apex of fourth segment § *Gerbillophilus* Wagner.
Longest apical bristle of second hind tarsal segment not extending beyond apex of fourth segment..... § *Nosopsyllus* Jordan (*sensu stricto*).
3. Inner surface of mid- and hind coxæ with longish thin bristles not only on apical half but also on basal half. Male, anal sternite projecting considerably beyond anal tergite. Bursa copulatrix sac-shaped..... 4.
Inner surface of mid- and hind coxæ with longish thin bristles only on apical half 5.
4. Male, 8t with dorsal spiculose area on inner side. Posterior apex of finger with stout bristles or a pair of sharp spiniforms which are not close to each other. Female, two antepygial bristles.

Citellophilus Wagner.

- Male, 8t without dorsal spiculose area on inner side. Posterior apex of finger with two short, blunt, dark spiniforms which are close to each other. Female, three antepygidial bristles..... *Callopsylla* Wagner.
5. Pronotal comb consisting of twenty-four spines or more, seldom twenty-three. Male, 8t with dorsal spiculose area on inner side.

Ceratophyllus Curtis (*sensu stricto*).

- Pronotal comb consisting of less than twenty-four spines. Male, 8t without dorsal spiculose area on inner side.

Monopsyllus Kolenati (*sensu stricto*).

1. Subgenus *CERATOPHYLLUS* Curtis, 1832 (*sensu stricto*)

Frontal row developed, two to seven bristles in female. Eyes developed. Labial palpus not reaching to apex of fore coxa. Bristles of second antennal segment extending to middle or three-fourths of club in male and beyond apex of club in female. First occipital row consisting of none or one bristle, second occipital row consisting of two bristles. Pronotal comb with twenty-four or more spines. Inner surface of mid- and hind coxæ with longish thin bristles only on apical half. Longest bristle of second hind tarsal segment not reaching beyond apex of fourth segment. Male, one long antepygidial bristle, other two minute. 8t with spiculose area. 8s rodlike, with apical bristles (often spiniform) and membranous apical flap. 9s with apex of anterior arm widened posteriorly and with antemedian portion of posterior arm roundly dilated. Female, three antepygidial bristles (one long, other two much shorter). Stylet with one to three lateral bristles. Bursa copulatrix and spermatheca variable, in typical species portion of duct of spermatheca nearest bursa copulatrix more strongly sclerotized, being a conspicuous tube, head of spermatheca cylindrical, concave above, several times as long as broad.

Key to the species of the subgenus Ceratophyllus.

1. Female, apex of 7s strongly rounded. Male, anterior and posterior margins of finger almost parallel in upper half. Notch of anterior margin of finger at or near third from bottom. 8s with two or three apical bristles on each side..... *C. gallinæ* (Schrank).
 Female, apex of 7s rounded in upper half, incurved in lower half. Male unknown *C. sinicus* Jordan.

CERATOPHYLLUS (*CERATOPHYLLUS*) *GALLINÆ* (Schrank, 1803). Text figs. 4 and 5.

Frontal row present. First occipital row represented by one bristle near base of antennal groove, second occipital row composed of a short and a long bristle above middle of antennal groove. Pronotal comb one-eighth shorter than pronotum and consisting of twenty-six to twenty-eight spines. Apical area of

metanotum one-third shorter than corresponding area of mesonotum and bearing on each side two short apical spines.

Male.—8*t* with six or seven bristles at and near margin and a few on lateral surface. 8*s* evenly curved, with two or three long apical bristles on each side, these bristles about one-fifth shorter than finger. Process of clasper short, triangular. Finger four times as long as broad, posterior margin slightly incurved below center, then feebly convex, apex rounded. Finger excluding basal region of almost even width; three long bristles on apical half of posterior margin, upper bristle thinner and shorter than others; in between upper bristle and the next a short thin spinelike bristle; finger measured from most ventral point to upper anterior angle with notch of anterior margin at one-third or two-fifths from bottom. End piece of paramere twice as long as width of finger.

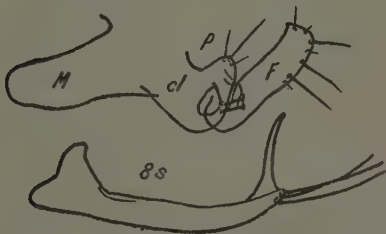


FIG. 4. *Ceratophyllus* (*Ceratophyllus*) *gallinæ*, male. (After Jordan and Rothschild.)

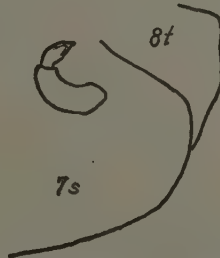


FIG. 5. *Ceratophyllus* (*Ceratophyllus*) *gallinæ*, female. (After Jordan and Rothschild.)

Female.—Apex of 7*s* strongly rounded, without sinus. 8*t* with three to five bristles below stigma, one or two long, on ventral area of 8*t* about a dozen bristles. Stylet about three times as long as broad. Head of spermatheca long and slender, almost three times as long as broad, and twice length of tail, which is two-thirds width of head.

2. CERATOPHYLLUS (CERATOPHYLLUS) SINICUS Jordan, 1932. Text fig. 6.

Female.—Anterior frontal row composed of four or five bristles. Pronotum with a comb of twenty-eight spines and a row of fourteen long bristles. On meso- and metanota a row of eleven to twelve bristles and in front of row about twenty-two small bristles. Mesonotum with eight false spines. Metepimeron with three rows of bristles (two or three, three, one). Apex of 7*s* slightly incurved in ventral half, upper half strongly rounded and projecting beyond ventral half. 8*t* with ten or

eleven bristles above stigma and three or four below stigma. Stylet less than twice as long as broad, and provided with three lateral bristles. Apex of bursa copulatrix sclerified. Sclerified portion of duct of spermatheca as long as bursa copulatrix and duct combined. Spermatheca with a curved cylindrical head which is about three times as long as tail; tail only little narrower than head.

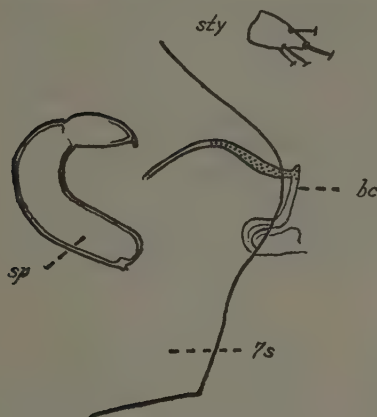


FIG. 6. *Ceratophyllus (Ceratophyllus) sinicus*, female.
(After Jordan.)

2. Subgenus **MONOPSYLLUS**
Kolenati, 1857

Frontal row present, one to five bristles in female. Eye not reduced. Labial palpus reaching about to apex of fore coxa. Bristles of second antennal segment reaching, or not reaching, to middle of club in male

and to one-half to three-fourths in female. First occipital row of none to two bristles with one bristle as a rule, second row of two bristles. Pronotal comb of twenty-two or fewer spines. Inner surface of mid- and hind coxæ with longish thin bristles at most in apical half. None of bristles of first and second hind tarsal segments extending beyond following segment.

Male.—Three antepygidial bristles, one long, outer two of varying stoutness. 8t without dorsal spiculate area on inner side. 8s narrow, with or without membranous apical flap. Frontal margin of 9t forming with manubrium of clasper an acute, rounded-off angle.

Female.—Three antepygidial bristles. Stylet with two lateral bristles. Spermatheca of various forms.

3. **CERATOPHYLLUS (MONOPSYLLUS) ANISUS** Rothschild, 1908. Text figs. 7 and 8.

Frontal tubercle prominent. Occiput with one long bristle above middle of hind margin of antennal groove and a smaller one above long bristle. Pronotal comb composed of sixteen to twenty spines. Longest apical bristle of second hind tarsal segment somewhat shorter than third segment.

Male.—8*t* with seven or eight bristles above and two below. 8*s* very long and slender, little curved and ventrally near apex with two pairs of bristles. Process of clasper conical. Finger elongate, anterior apex pointed, posterior apex rounded, anterior margin distinctly excurved above acetabular bristles. Anterior arm of 9*s* strongly curved; central widened portion of posterior arm with numerous bristles.

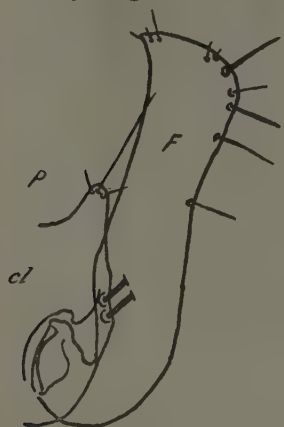


FIG. 7. *Ceratophyllus (Monopsyllus) anisus*, male. (After Jordan.)

Female.—Three antepygidial bristles rather short. Apex of 7*s* rounded in outline. 8*t* with several bristles below stigma, of which only one is very stout. Spermatheca resembling that of *Ceratophyllus* on birds, with its cylindrical head about three times as long as tail.

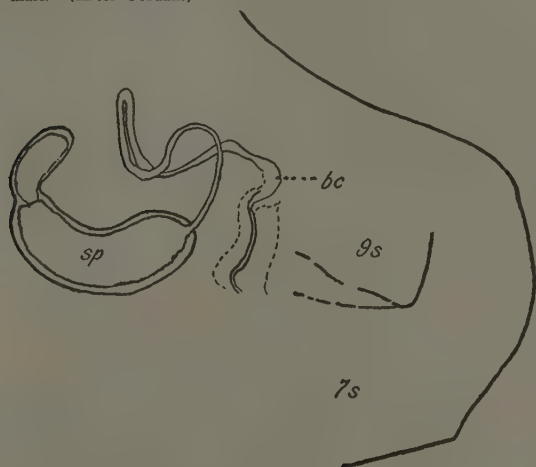


FIG. 8. *Ceratophyllus (Monopsyllus) anisus*, female. (After Jordan.)

3. Subgenus NOSOPSYLLUS Jordan, 1933 (sensu lato)

Frontal row absent or present (none to six bristles in female). Eyes not reduced. Labial palpus with apex reaching to or beyond apex of fore coxa. Bristles of second antennal segment not reaching to one-third of club in male, but reaching to middle

or beyond apex of club in female. First occipital row composed of none to two bristles, second row of one or two bristles. Pronotal comb composed of fewer than twenty-four spines. Inner surface of mid- and hind coxæ with longish thin bristles at most in apical half. Longest bristle of second hind tarsal segment reaching or not reaching beyond apex of fourth segment.

Male.—One long antepygidial bristle, upper bristle short and stout, lower rudimentary. 8t without dorsal spiculose area on inner side. 8s rudimentary or quite small, within 7s, without bristles. 9s with anterior arm triangularly dilated on frontal side below apex and with posterior arm sinuate at middle.

Female.—Three antepygidial bristles. Stylet with one single apical bristle and one lateral bristle. Spermatheca with nearly globular head and long cylindrical tail. Bursa copulatrix with long sclerotized duct, upper end membranous, rolled up in a spiral.

Key to the sections of the subgenus Nosopsyllus.

1. Labial palpus reaching to about apex of fore coxa. Frontal row composed of one to six bristles in female. Bristles of second antennal segment reaching to middle or beyond apex of club in female. Longest bristle of second hind tarsal segment not reaching beyond apex of fourth segment..... *Nosopsyllus* Jordan (*sensu stricto*).
- Labial palpus reaching to, or beyond, apex of fore coxa. Frontal row absent in female. Bristles of second antennal segment reaching beyond apex of club in female. Longest bristle of second hind tarsal segment reaching beyond apex of fourth segment..... *Gerbillophilus* Wagner.

4. *CERATOPHYLLUS* (*NOSOPSYLLUS*) *FASCIATUS* Bosc, 1801. Text figs. 9 and 10.

Pronotal comb composed of about eighteen spines. Longest bristle of second hind tarsal segment not reaching to apex of

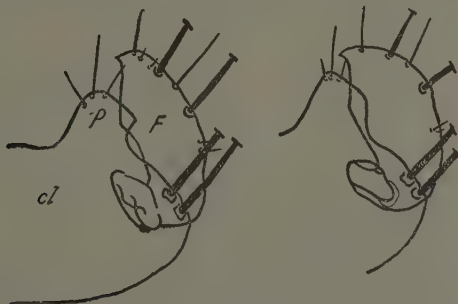


FIG. 9. *Ceratophyllus* (*Nosopsyllus*) *fasciatus*, male, variations of clasper, process, and finger. (After Jordan and Rothschild.)

third segment. Fifth tarsal segments all slightly shorter than third hind tarsal segments.

Male.—8t rounded posteriorly. 8s small and situated within 7s. Angle formed by dorsal portion of 9s and manubrium very obtuse. Process of clasper short, broad, truncate at apex. Posterior margin of finger in form of a semicircle; finger widest at notch of anterior margin and about twice as long as broad; apex hooked and directed frontad; upper half of posterior margin provided with two large bristles, upper bristle nearly always distinctly shorter than lower bristle; a thin bristle between stout bristles and another near apex; below middle of margin a third thin bristle accompanied by a smaller



FIG. 10. *Ceratophyllus* (*Nosopsyllus*) *fasciatus*, female, variations of seventh sternite and spermatheca. (After Jordan and Rothschild.)

one. Anterior arm of 9s with a ventral sinus at apex; proximal to deep ventral sinus of posterior arm usually one or two bristles larger than others.

Female.—Apex of 7s more or less irregularly rounded or slanting, sometimes slightly incurved, never distinctly sinuate. Stylet almost three times as long as broad, upper lateral bristle wanting. Spermatheca with nearly globular head; tail of even width and much longer than head.

5. *CERATOPHYLLUS* (*GERBILLOPHILUS*) *LÆVICEPS* Wagner, 1929. Text fig. 11.

Frontal tubercle prominent. Occiput with one stout bristle behind posterior antennal margin. Pronotal comb composed of twenty to twenty-two spines. Mesonotum with two rows and

metanotum with three rows of bristles. Metepimeron with three rows of bristles (one or two, three or four, one or two). Abdominal sternites of typical female *læviceps* with numerous bristles. The present subspecies differs from the typical form in the absence of a group of additional lateral bristles on basal sternites and by a smaller number of bristles on abdominal sternites.

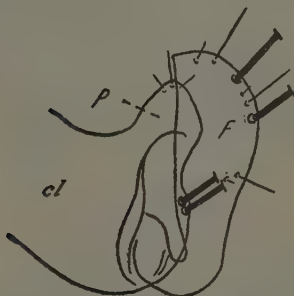


FIG. 11. *Ceratophyllus* (*Gerbillophilus*) *læviceps læviceps*, male. (After Wagner.)

Male.—8t provided with six or seven marginal bristles along dorsal margin (instead of thirteen in the typical subspecies, *læviceps læviceps* Wagner, 1909). Process of clasper thumblike, provided with three hairs at apex. Manubrium tapering toward apex which is, however, not pointed, but more or less rounded. Finger widest at distal third and less obliquely truncate at apex (obliquely

truncate in *læviceps læviceps*); posterior apical margin with two bristles, which are less apart than in the typical subspecies. Proximal apex of 9s enlarged into a club which is, however, drawn out into a pointed apex; distal apex less markedly tapering or narrowed and provided with two spiniforms.

Female.—7s with a more or less truncate apex. 8t deeply sinuate at posterior apex and provided with numerous bristles near apical portion. Spermatheca with short oval head and a tail of even width.

4. Subgenus CALLOPSYLLA Wagner, 1934

Frontal row either absent or unstable (as many as six bristles may be present). Eyes developed or nearly rudimentary. Labial palpus extending almost always to apex of fore coxa. Bristles of second antennal segment reaching at most to middle of club in male, but beyond apex of club in female. First occipital row consisting of none to two bristles, second occipital row of one to five bristles. Pronotal comb composed, as a rule, of less than twenty-four spines, in one group composed of twenty-four to twenty-six spines. Inner surfaces of mid- and hind coxæ with longish thin bristles from base (at least one) to apex. Longest apical bristles of second hind tarsal segment not reaching beyond apex of fourth segment.

Male.—One developed antepygidial bristle. 8t without spiculate area. 8s with apical membranous lobe or flap. Finger triangular or quadrangular, with two short blunt spiniforms which are close to each other and below which is a thickened bristle. Anal sternite projecting far beyond anal tergite.

Female.—Three antepygidial bristles. Head of spermatheca barrel-shaped. Ductus obturatorius present. Bursa copulatrix with a saclike widening, usually with sclerotized incrassation. Three species known from China.

Key to the species of Callopsylla.

1. Frontal row reduced (none to three bristles). Two occipital rows reduced (none or one, one). Pronotal comb composed of less than twenty-four spines. Male, process of clasper long (more than twice as long as wide at base), dilated at apex. Finger with more or less rounded posterior apex. Female, apex of 7s truncate and slightly incurved twice 2.
- Frontal row developed (five or six bristles). Two occipital rows developed (one or two, four or five). Pronotal comb composed of twenty-four to twenty-six spines. Male, process of clasper short (as long as wide at base), not distinctly dilated at apex. Finger with sharp posterior apex. Female, apex of 7s with a sinus, upper and lower lobes equally rounded off *C. (C.) kaznakovi* Wagner.
2. Male, anterior and posterior margins of finger strongly arched, distal margin evenly rounded. Female unknown.... *C. (C.) kozlovi* Wagner.
- Male, anterior and posterior margins of finger not strongly arched, anterior margin with an excurving and distal margin more or less straight. Female, apex of 7s truncate and slightly incurved twice.

C. (C.) dolabris Jordan et Rothschild.

6. CERATOPHYLLUS (CALLOPSYLLA) KOZLOVI Wagner, 1929. Text fig. 12.

Male.—Frontal tubercle prominent. Frontal row consisting of two or three bristles. First occipital row with only one very feeble bristle. Pronotal comb composed of eighteen or nineteen spines. 8s on apex with three pairs of ventral bristles and a large, wide, membranous, apical, lateral lobe. Finger dilated at apex, sharply narrowed at basal portion so that it looks like a mushroom; hind dorsal corner with a pair of curved blunt spiniforms.



FIG. 12. *Ceratophyllus* (*Callopsylla*) *kozlovi*, male. (After Wagner.)

7. CERATOPHYLLUS (CALLOPSYLLA) DOLABRIS Jordan et Rothschild, 1911. Text figs. 13 and 14.

Frontal tubercle prominent. Bristles of second antennal segment of female long, at least five reaching beyond apex of club. Occiput with one long bristle above antennal groove. Pronotal comb composed of seventeen or eighteen spines, usually an additional small spine on each side. Meso- and metanota with two rows of bristles (six, twelve on two sides together). Metepimeron with four to six bristles (one or two, two or three, one). Longest apical bristle of second hind tarsal segment reaching beyond apex of third segment.

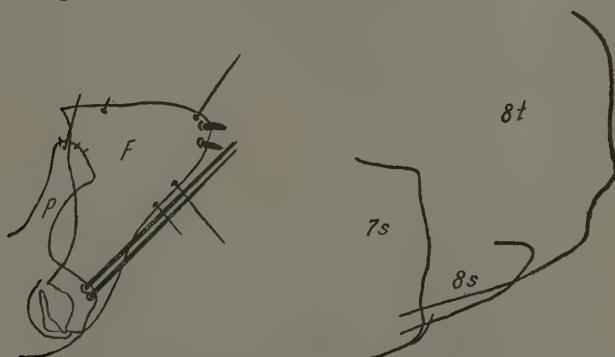


FIG. 13. *Ceratophyllus (Callopsylla) dolabris*, male. (After Jordan and Rothschild.)

FIG. 14. *Ceratophyllus (Callopsylla) dolabris*, female. (After Jordan and Rothschild.)

Male.—8t with three bristles below stigma, a row of six to eight bristles at upper edge of apical lobe, with one or two bristles close to row and an irregular row of five or six bristles near ventral edge. 8s with three apical bristles on each side. Process of clasper dilated at apex. Finger triangular, upper apical margin on the whole more or less truncate though slightly wavy, anterior apical corner acute, on posterior apical corner two pointed spiniforms, above which is a long bristle and a little farther below, two long bristles. 9s with central ventral lobe of posterior arm bearing a number of rather strong, short bristles at apex; thin, pale, distal lobe paramecium-shaped.

Female.—7s truncate at apex, slightly incurved twice. 8t with five or six bristles below stigma in two rows, upper angle of apical lobe strongly rounded.

8. CERATOPHYLLUS (CALLOPSYLLA) KAZNAKOVI Wagner, 1929. Text fig. 15.

Frontal tubercle marked. Frontal row composed of five or six bristles. First occipital row consisting of one or two, second of three to five bristles. Pronotal comb consisting of twenty-four spines. Longest apical bristle of first hind tarsal segment longer than second segment.

Male.—8s with two pairs of long subapical bristles and a nearly quadriform membranous lateral lobe. Process of clasper short and broad. Finger ax-shaped, fore and hind margins incurved, on posterior apex a pair of closely set, short spiniforms, immediately below these a long acute spine. Anterior arm of 9s nearly straight.



FIG. 15. *Ceratophyllus (Callopsylla) kaznakovi*, male. (After Ioff.)

Female.—Central antepygidial bristle about twice as long as others. Apex of 7s distinctly sinuate, upper and lower lobes equally rounded off. 8t with considerably stout marginal bristles and about ten lateral bristles.

5. Subgenus CITELOPHILUS Wagner, 1934

Frontal row absent or only uppermost bristle present. Eyes developed. Labial palpus with its apex reaching or beyond apex of fore trochanter. Bristles of second antennal segment reaching at most to middle of club in male, but reaching beyond club in female. First occipital row lacking, second represented by only one bristle. Inner surface of mid- and hind coxæ with longish thin bristles from base to apex. Apical bristles of second hind tarsal segment not reaching beyond apex of fourth segment.

Male.—One developed antepygidial bristle on each side. 8t with spiculose area. 8s somewhat shortened, with apical lobe. Finger triangular, provided with stout bristles or a pair of spiniforms which are wide apart. Anterior arm of 9s not curved but straight. Anal sternite longitudinally divided into two halves or lobes, projecting far beyond anal tergite.

Female.—Two antepygidial bristles as a rule. Spermatheca with egg-shaped head and large, irregular, spindle-shaped tail. Only one species of this subgenus occurs in China.

Key to the subspecies of *Ceratophyllus (Citellophilus) tesquorum*.

1. Female, apex of 7s slanting or undulating. Ten bristles of second antennal segment reaching to apex of club or beyond. Spermatheca with head as long as tail.

C. (C.) tesquorum famulus Jordan et Rothschild.

Female, apex of 7s more or less truncate and with central excurving.

About five bristles of second antennal segment reaching to the apex of club or beyond. Spermatheca with head slightly shorter than tail..... 2.

2. Male, apex of finger more slanting and rounded.

C. (C.) sungaris Jordan.

Male, apex of finger neither slanting nor rounded. Female, apex of 7s truncate and slightly excurved at middle.

C. (C.) mongolicus Jordan et Rothschild.

9a. CERATOPHYLLUS (CITELLOPHILUS) TESQUORUM MONGOLICUS Jordan et Rothschild, 1911. Text fig. 16.

Frontal tubercle small, pronotal comb composed of twenty spines. Labial palpus reaching a little beyond trochanter and therefore longer than that of typical *tesquorum* Wagner. First midtarsal segment distinctly shorter than second. Meso- and metanota with two rows of bristles. Metepimeron with six bristles (two, three, one).

Male.—8s with some weak hairs instead of five short, thick bristles. Process of clasper much less dilated at apex than in



FIG. 16. *Ceratophyllus (Citellophilus) tesquorum mongolicus*, male. (After Jordan and Rothschild.)

tesquorum tesquorum. Manubrium of even width, rounded at apex. Finger triangular, widest at apex, with two widely separated spiniforms on upper half of posterior margin. Finger

as a whole much less widened at apex, apical margin one-fourth shorter than in typical *tesquorum*, proportions of length and width of finger 7 : 4 in *mongolicus* and 7 : 5 in *tesquorum*.

Female.—7s on each side with a row of twelve or thirteen bristles and about six small bristles before this row; apex like in typical *tesquorum*, truncate, margin very slightly excurved centrally. 8t with a cluster of five or six bristles below stigma and about fifteen bristles at and near ventral and apical margins, apex widely sinuate below rounded upper lobe.

9b. CERATOPHYLLUS (CITELLOPHILUS) TESQUORUM SUNGARIS Jordan, 1929. Text fig. 17.

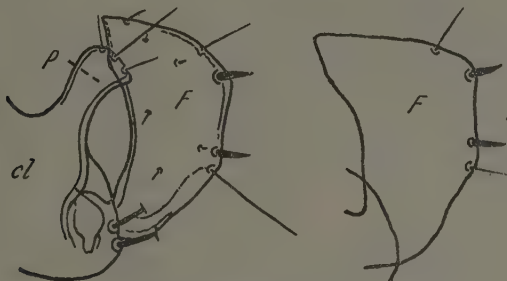


FIG. 17. *Ceratophyllus (Citellophilus) tesquorum sungaris*, male, variations. (After Jordan.)

Male.—Allied to *C. (C.) tesquorum mongolicus*. Differs in that the finger is more rounded posteriorly, with the apical margin more slanting than in other known subspecies.

Female unknown.

9c. CERATOPHYLLUS (CITELLOPHILUS) TESQUORUM FAMULUS Jordan et Rothschild, 1911. Text fig. 18.

Female.—Ten bristles of second antennal segment reaching to, or beyond, apex of club. Two apical antennal bristles of second hind tarsal segment extending to apex of third segment or beyond. Apical margin of 7s slanting and slightly undulating. Seventh segment with ten long bristles in a row and about thirty additional bristles, on the two sides together. 8t with two rows of bristles beneath stigma and about sixteen bristles on lower half, apex of 8t rounded-truncate with a dorsal sinus, above which is a distinctly produced upper angle. 9s with several small bristles. Stylet in shape resembling champagne bottle, twice as long as broad at base. Head of spermatheca as long as tail.

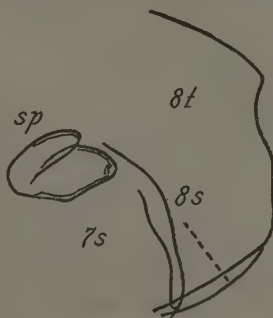


FIG. 18. *Ceratophyllus (Citellophilus) tesquorum famulus*, female. (After Jordan and Rothschild.)

SPECIES INCERTÆ SEDIS

Under the genus *Ceratophyllus* there are two other species the actual position of which is not yet clear, owing to the insufficiency of material at present, as remarked by Wagner (1934). Moreover, their original descriptions, based on a single female, do not permit of exact determination. For the sake of convenience these species may for the present be retained under the name *Ceratophyllus*, although it is improbable that they will remain there.

10. CERATOPHYLLUS (?) PHÆOPSIS Jordan at Rothschild 1911. Text fig. 19.

Female.—Front very slanting; frontal tubercle about halfway between oral corner and central sensory organ (pale spot). Eyes feebly pigmented except anterior and posterior edges, appearing deeply excised at a certain focus. Labial palpus reach-

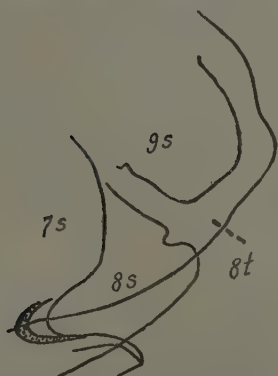


FIG. 19. *Ceratophyllus* (?) *phæopsis*, female. (After Jordan and Rothschild.)

ing to apex of forecoxa. Three long bristles in front of eye, uppermost bristle placed near antennal groove. Occiput bearing one bristle above antennal groove and subapical row of five bristles. Bristles on second antennal segment minute. Pronotal comb composed of eighteen spines. Meso- and metanota bearing each two rows of bristles. Metepimeron with eight bristles (four, three, one). Second hind tarsal segment bearing an apical bristle reaching beyond apex of fourth segment and

another bristle beyond apex of third segment. Fifth hind tarsal segment with five pairs of lateral plantar bristles. Abdominal tergites and sternites each bearing two rows of bristles. Three antepygial bristles, lower bristle but little shorter than middle bristle. Apex of 7s with a deep sinus strengthened proximally by a curved bandlike incassation. 8t with three bristles below stigma, apical margin rounded. Stylet short, bottle-shaped, twice as long as broad at base. Spermatheca distorted, head appearing round and much shorter than tail.

CERATOPHYLLUS (?) SPARSILIS Jordan et Rothschild, 1922. Text fig. 20.

Female.—Front gradually and strongly slanting, with a row of three long bristles in front of eye. Labial palpus reaching to middle of fore trochanter. Five bristles of second antennal segment reaching far beyond club. Occiput with one long bristle above middle of antennal groove and a subapical row of five or six bristles. Pronotal comb consisting of twenty spines. Meso- and metanota with two rows of bristles. Six bristles on metepimeron (two, three, one). Fore femur with two or three dorsolateral bristles. Inner surface of mid- and hind coxæ with slender bristles extending to base. Longest bristle of second hind tarsal segment reaching to apex of third segment. Apex of 7s gradually rounded. 8t with eight to ten bristles above stigma and six below stigma, of which three are long. Stylet bottle-shaped, with one apical bristle and one ventrolateral bristle. Spermatheca with elongated head which is twice as long as broad. Bursa copulatrix sclerotized.

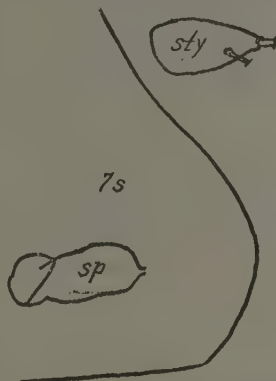


FIG. 20. *Ceratophyllus* (?) *sparsilis*, female. (After Jordan and Rothschild.)

2. Genus DIAMANUS Jordan, 1933

Labial palpus reaching beyond apex of fore trochanter. Ocular bristle situated lower than upper margin of eye. Bristles of second antennal segment in male short. Inner surface of mid- and hind coxæ with longish thin bristles from base to apex. Outer surface of fore femur with several small lateral bristles. Longest bristle of second hind tarsal segment reaching beyond apex of fourth segment. First pair of plantar bristles situated laterally as are other pairs.

Male.—One developed antepygial bristle, the other two rudimentary. 8s quite small. Finger swordlike. Ejaculatory duct normal.

Female.—Two antepygial bristles. Stylet with one apical bristle and with dorsal lateral bristle much smaller than ventral one. Spermatheca with globular head and slender tail.

Key to the species of Diamanus.

1. Inner surface of mesonotum near apex with eight to twelve bristlelike spines. Male, finger more or less straight. Manubrium slightly dilated at apex. Frontal margin of proximal portion of anterior arm of 9s strongly curved. Female, 8t sinuate at apex. Tail of spermatheca slightly, if not, dilated at apical third.

D. mandarinus (Jordan et Rothschild).

Inner surface of mesonotum without bristlelike spines near apex. Male, finger strongly curved. Manubrium distinctly dilated at apex. Frontal margin of proximal portion of anterior arm of 9s more or less straight. Female, 8t rounded at apex. Tail of spermatheca strongly dilated at apical third..... *D. montanus* (Baker).

12. **DIAMANUS MANDARINUS** (Jordan et Rothschild), 1911. Text figs. 21 and 22.

Frontal tubercle situated at one-third or one-fourth distance from oral corner to antennal groove. Before eye two long

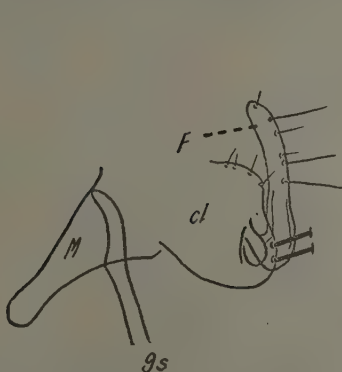


FIG. 21. *Diamanus mandarinus*, male. (After Jordan and Rothschild.)

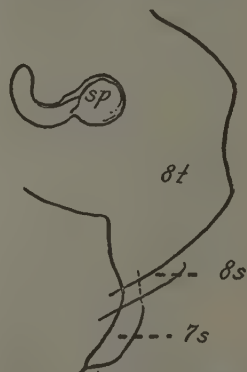


FIG. 22. *Diamanus mandarinus*, female. (After Jordan and Rothschild.)

bristles, ocular bristle accompanied by a smaller bristle. Two more bristles located more frontad in male, one near anterior margin of antennal groove and another behind maxillary palpus. Occiput with one bristle above antennal groove. Pronotal comb composed of eighteen to twenty-three spines. Inner surface of mesonotum near apex with nine to twelve bristlelike spines. Five bristles on metepimeron (two, two, one).

Male.—8t at dorsal margin beyond stigma with a row of four bristles, one below stigma, two on side, and two near ventral margin. 8s small, distally suddenly narrowed to a point. Clasper broad, upper angle rounded. Distal half of manubrium of

even width, slightly dilated at apex. Movable finger peculiarly slender, almost of same width throughout and with tip rounded off. Anterior arm of 9s very long and narrow; posterior arm divided by a deep ventral sinus, longer proximal portion at ventral margin with five or six bristles.

Female.—Apex of 7s evenly excurved below small upper apical angle. 8t above stigma, with eight to ten small bristles, two or three long bristles below stigma, and twelve long and ten to twelve shorter bristles on lower half; apex shallowly sinuate. Head of spermatheca globular, tail slender, about twice as long as head.

13. *DIAMANUS MONTANUS MONTANUS* (Baker), 1895. Text figs. 23 and 24.

Closely allied to preceding species. Pronotal comb composed of eighteen spines. Inner surface of mesonotum without bristle-like spines near apex.

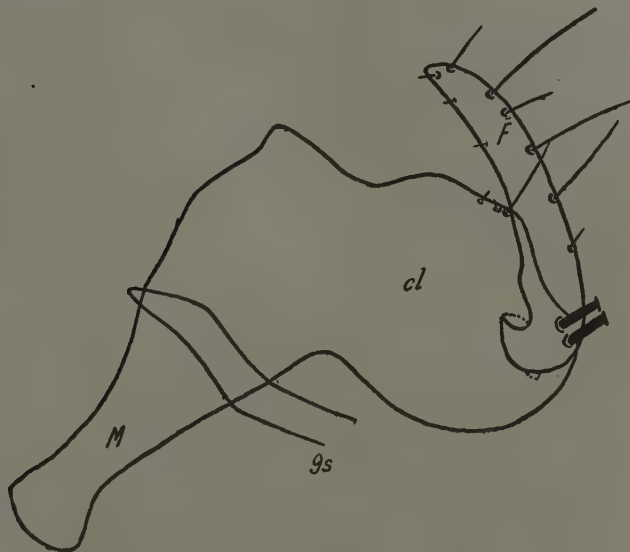


FIG. 23. *Diamanus montanus montanus*, male. (Author's drawing.)

Male.—Differing from preceding species in that the manubrium is strongly dilated at apex, the movable finger tapers gradually towards apex and is more or less curved, the proximal portion of the anterior arm of 9s is different in shape and curvature.



FIG. 24. *Diamanus montanus montanus*, female. (Author's drawing.)

Female.—Apex of 7s broadly rounded and with a ventral sinus. 8t rounded at apex. Tail of spermatheca strongly dilated at apical third.

3. Genus *OROPSYLLA* Wagner et Ioff, 1926

Eyes well developed. Frontal tubercle sharp, more or less sunken into front. Labial palpus reaching beyond apex of fore trochanter (1 to 1.5 joints beyond trochanter). Ocular bristle situated lower than upper margin of eye. Bristles of second antennal segment not reaching to middle of club in male, beyond apex in female. Inner surface of mid- and hind coxæ with longish thin bristles from base to apex. Outer surface of fore femur with several small lateral bristles. Longest apical bristle of second hind tarsal segment sometimes reaching beyond apex of fourth segment. First pair of plantar bristles situated laterally as are other pairs.

Male.—One long and one minute antepygidial bristle. 8s slender, without membranous apical lobe. Movable finger claviform. Process of clasper broad. Ejaculatory duct normal.

Female.—Three (two to five) antepygidial bristles. Stylet with one apical bristle and two to five lateral bristles. Head of spermatheca longer than broad, ovate or pyriform; tail short, usually not longer than head.

Key to the species of *Oropsylla*.

1. Frontal tubercle prominent. Labial palpus longer, apex of fourth joint at least on a level with base of fore trochanter. Pronotum (from basal margin to base of pronotal comb) longer than spines of pronotal comb. Male, posterior margin of movable finger semicircular in outline. Female, head of spermatheca smaller.... *O. silantiewi* (Wagner). Frontal tubercle barely traceable. Labial palpus shorter. Pronotum shorter than spines of pronotal comb. Male unknown. Female, head of spermatheca larger..... *O. elana* Jordan.
2. Female, no apical bristles on second hind tarsal segment extending beyond apex of third segment. Apical margin of 8t more or less truncate, slightly incurved twice..... *O. silantiewi silantiewi* (Wagner). Female, two apical bristles of second hind tarsal segment extending beyond apex of third segment. Apical margin of 8t also truncate, slightly incurved once.... *O. silantiewi crassus* (Jordan et Rothschild).

14a. *OROPSYLLA SILANTIEWI SILANTIEWI* (Wagner, 1898). Text figs. 25 and 26.

Frontal tubercle marked. Front of male obliquely vertical. Labial palpus reaching to a little beyond middle of fore femur.

Antennal groove widely open behind. Central part of eye not pigmented. A stout median bristle above middle of hind margin



FIG. 25. *Oropsylla silantiewi silantiewi*, male, variations. (A and B, author's drawings; C, after Wagner.)

of antennal groove. Head feebly bristled, thorax and abdomen heavily bristled. Pronotal comb consisting of eighteen spines. None of apical bristles of hind tarsal segments exceeding apex of following segment. Oftentimes abdominal bristles in female not lying in rows and ventral side of abdomen presenting a hairy appearance.

Male.—Clasper broad and short, process very much rounded. Movable finger shaped like a part of circle along its posterior margin, gradually rounded off at apex. Manubrium tapering to a pointed apex. Cephalic portion of anterior arm of 9s rectangular with the exception of an extra proximal process.

Female.—Apex of 7s truncate. Apical margin of 8t more or less truncate, being slightly incurved twice. Head of spermatheca shorter than tail, a little less than twice as broad as tail.

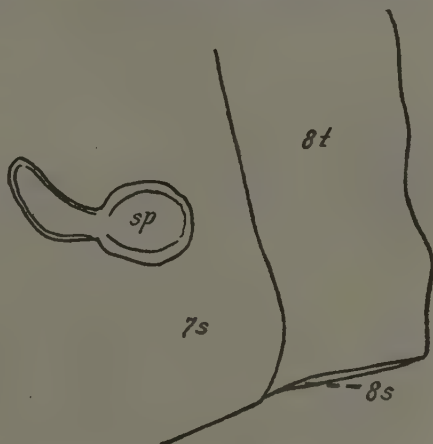


FIG. 26. *Oropsylla silantiewi silantiewi*, female. (Author's drawing.)

14b. *OROPSYLLA SILANTIEWI CRASSUS* (Jordan et Rothschild), 1911. Text fig. 27.

Female.—Similar to *O. silantiewi silantiewi*. Labial palpus shorter than that of *silantiewi*, apex of fourth joint on a level with base of fore trochanter. Pronotal comb of twenty to twenty-three spines. Two apical bristles of second hind tarsal

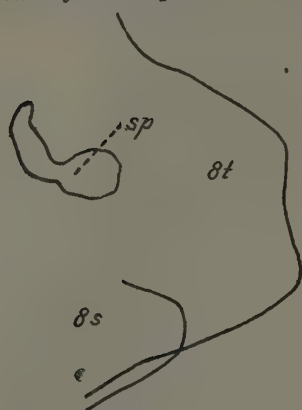


FIG. 27. *Oropsylla silantiewi crassus*, female. (After Jordan and Rothschild.)

segment reaching beyond apex of third segment. Mesonotum with numerous bristlelike spines on inner surface. Abdominal tergites bearing three rows of bristles, anterior row more or less irregular, second row reaching down to stigma, last row with two or three bristles below stigma. Apex of 8t obliquely truncate and slightly incurved. 8t bearing two long bristles below stigma, numerous bristles on lower half and three or more strong short bristles on inner surface. Stylet with three lateral bristles, two dorsal and one ventral. Spermatheca with a rounded head which is shorter than tail.

15. *OROPSYLLA ELANA* Jordan, 1929. Text fig. 28.

Female.—Allied to *O. silantiewi crassus*. Frontal tubercle barely traceable. Labial palpus shorter than that of *crassus*.



FIG. 28. *Oropsylla elana*, female. (After Jordan.)

Apex of genal process evenly rounded, dorsally not more projecting than ventrally, a little shorter than in *crassus*. Pronotum shorter than spines of comb; comb composed of twenty-three to twenty-six spines. 7s more or less truncate at apex, upper angle distinct, sometimes a little more rounded than in figure, apex slightly variable, sometimes a little convex below middle, sometimes nearly straight or very slightly incurved. 8t bearing two to six bristles below stigma and many others on widened portion.

Head of spermatheca larger than in *O. silantiewi crassus*, somewhat variable in shape.

4. Genus AMPHALIUS Jordan, 1933

Eyes well developed. Frontal tubercle sharp, more or less sunken into front. Labial palpus reaching about apex of fore trochanter. Ocular bristle situated lower than upper margin of eye. Bristles of second antennal segment reaching to three-fourths length of club in male and beyond apex in female. Pronotal comb consisting of more than twenty-four spines. Inner surface of mid- and hind coxæ with longish thin bristles from base to apex. Outer surface of fore femur with several small lateral bristles. Longest apical bristle of second hind tarsal segment not reaching beyond apex of fourth segment. First pair of plantar bristles somewhat shifted inward. 7t slightly projecting medianly in between two sets of antepygidial bristles.

Male.—One long antepygidial bristle. 8t very large, provided with dorsal spiculose area on inner side. 8s narrow, fringed on upper side with a large membranous fringed apical flap. Clasper with slender process. Movable finger with a long ventral process dilated at apex. Ejaculatory duct deeply coiled twice, apex directed frontad.

Female.—Three antepygidial bristles. Anal sternite with cylindrical stylet, the apex of which is rounded off and bears numerous bristles. Anal sternite angulate beneath, with bristles in apical half only. Spermatheca long, without distinct division between head and tail. Bursa copulatrix very long and broad.

Key to the species of *Amphalius*.

1. Male, process of clasper distinctly dilated at apex. Finger slender, sub-apical long bristle of ordinary type. Female, upper lobe of 7s broad. *A. clarus* (Jordan et Rothschild).
- Male, process of clasper very slightly dilated at apex. Finger broader, subapical bristle of a peculiar type, flattened like a blade. Female, upper lobe of 7s narrow..... *A. runatus* (Jordan et Rothschild).

16. AMPHALIUS RUNATUS (Jordan et Rothschild, 1923). Text fig. 29.

FIG. 29. *Amphalius runatus*, male. (After Jordan and Rothschild.)

Closely allied to *A. clarus*.

Male.—Process of clasper much slender, apex only slightly dilated. Finger much wider, subapical bristle broadened, flattened, bladeliike, terminating in a long thin point. This single character is sufficient to distinguish this species from other members of the genus.

Female.—Almost identical with *A. clarus*.

Two lobes of 7s varying to some extent, upper lobe narrower. Spermatheca V-shaped. Bursa copulatrix long, slightly broader than head.

17. AMPHALIUS CLARUS (Jordan et Rothschild, 1922). Text figs. 30 and 31.

Front with two rows of bristles (six, three). A long bristle accompanied by a small upper bristle above middle of posterior margin of antennal groove. Pronotal comb consisting of twenty-nine or thirty spines. Meso- and metanota with two rows of bristles and a few additional dorsal bristles. Three antepygial bristles in female and a long bristle on a slightly projecting cone in male. First midtarsal segment with numerous long and slender bristles, longest bristle reaching to apex of third segment, three apical bristles of second hind tarsal segment reaching to base of fourth segment. First pair of plantar bristles of fifth segment of all tarsi distinctly shifted on to under surface.

Male.—8t bearing more than thirty bristles. 8s bearing distally a membranous fringed flap, the surface of which is clothed with numerous filaments. Manubrium of clasper of even width from near base to apex, which is rounded. Process of clasper long, apically rounded-dilated. Movable finger gradually narrowing upwards with apex bent frontad, widening out ventrally into a conical process armed with a short, stout, pointed, apical spine; this process again bearing a long appendage ex-

tending in an oblique anteroposterior direction, widened at apex. Anterior arm of 9s slender, apex acuminate, pointed upwards; posterior arm narrow, terminated by a ventral sinus. Flap beginning at this sinus very broad, bearing an obtuse, curved gourdlike bristle at anterior margin close to base.

Female.—Apex of 7s bisinuate, two sinuses separated by a short triangular lobe, lobe above upper sinus large and obtuse. 8t with ten or eleven bristles above stigma and six long bristles below it; ventral portion of 8t widened out, bearing about forty bristles. A process (10t) present, projecting between two stylets, bearing long bristles at apex. Stylet twice as long as wide, with more than a dozen apical bristles. Bursa copulatrix long and broad, about twice as broad as spermatheca. Spermatheca U-shaped, without distinct division between head and tail.

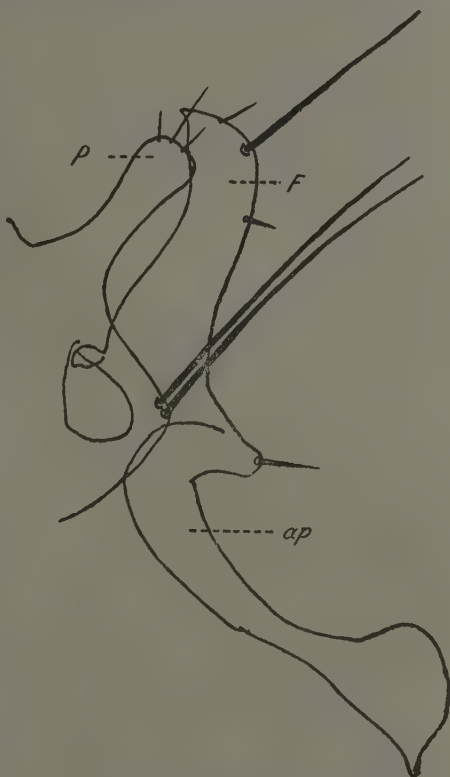


FIG. 80. *Amphilus clarus*, male. (After Jordan and Rothschild.)

5. Genus PARACERAS Wagner, 1916

Labial palpus reaching to or considerably beyond apex of fore trochanter (often with one joint beyond apex of trochanter). Frontal row represented by upper bristle. Ocular bristle situated lower than upper margin of eye. Bristles of second antennal segment reaching beyond apex of club in male and to middle in female. Pronotal comb present. Longest apical

bristle of second hind tarsal segment sometimes reaching beyond apex of fourth segment in male. First pair of plantar bristles situated laterally, like other parts. Outer surface of

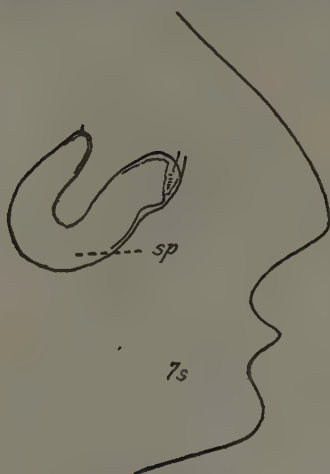


FIG. 31. *Amphalius clarus*, female. (After Jordan and Rothschild.)

fore femur usually without small lateral bristles. Inner surface of mid- and hind coxæ with a few longish thin bristles which may be situated on basal half.

Male.—Three spinelike antepygidial bristles, outer bristles much shorter. 8t strongly produced upwards into a lobe behind stigma, with dorsal spiculate area on inner side. 8s with complicated membranous apical flap bearing long fringes on ventral side. Dorsoposterior angle of finger produced into a lobe. Anal sternite not split, much longer than tergite.

Female.—Three antepygidial bristles. Stylet with one lateral bristle besides apical bristle. Head of spermatheca only slightly broader than tail. Apex of tail not sclerotized.

Key to the species of Paraceras.

1. Female, eye ball-shaped. Apex of 7s slanting or undulating. Male, process of clasper about one-third shorter than anterior margin of finger. Apex of finger more or less truncate. Distal apex of 9s narrowing almost to a point..... *P. crispus* (Jordan et Rothschild).
Female eye-shaped. Apex of 7s with a distinct ventral triangular lobe.
Male unknown..... *P. sinensis* (Liu).

18. *PARACERAS CRISPUS* (Jordan et Rothschild, 1911). Text figs. 32 and 33.

Fourth joint of labial palpus on a level with base of fore trochanter, fifth joint twice length of fourth. Pronotal comb composed of eighteen to twenty spines. Posterior margin of hind coxa of male incurved from one-fourth of margin to center. Hind tarsi with long and wavy bristles in male. Dorsal apical bristles of second and third hind tarsal segments of male fanlike radiate, longest bristle about equalling third, fourth, and fifth segments together.

Male.—Abdominal tergites except first tergite each with two rows of bristles. 8t with about twenty bristles in upper half of apical lobe, none in lower half. 8s narrow, curved, ventrally bearing two bristles; distal portion membranous, divided into a large fringed ventral flap and several long dorsal filaments. Clasper small, process slightly club-shaped, located much below apex of finger. Finger large, somewhat pentagonal, anterior margin distinctly incurved, ventral portion conical, apex more or less truncate; membranous lobe or appendage rounded at apex. Dorsal center of finger provided with a row of short spinelike bristles. Anterior arm of 9s broad, curved; posterior arm relatively narrow and pointed at apex.

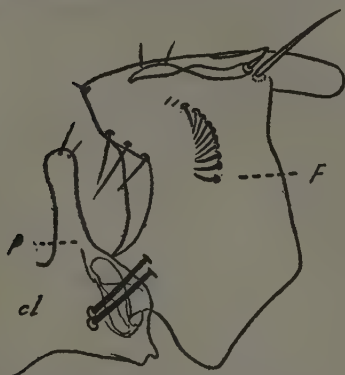


FIG. 32. *Paraceras crispus*, male. (After Jordan and Rothschild.)

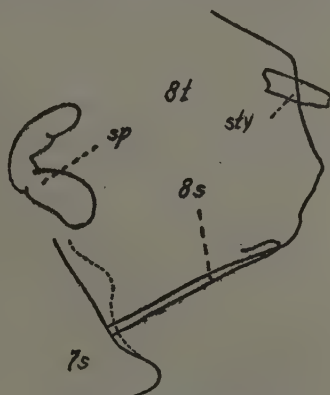


FIG. 33. *Paraceras crispus*, female. (After Jordan and Rothschild.)

Female.—Apex of 7s slanting, more or less undulating; ventral angle projecting out. 8t with four to seven bristles above stigma and below it one long bristle accompanied by one to four small bristles and twelve long bristles on lower half; apical margin angulate below middle. Spermatheca slender, with head shorter but slightly broader than tail.

19. *PARACERAS SINENSIS* (Liu, 1935). Text fig. 34.

This species was described under the genus *Oropsylla*. Later the eye dimensions, the length of the bristles of the second antennal segment, and other characters seemed to identify it as a member of *Paraceras* rather than of *Oropsylla*. Unfortunately the male is unknown.

Female.—Frontal tubercle prominent. Fourth joint of labial palpus reaching to middle of fore trochanter. One frontal bristle in front of anterior margin of antennal groove. Occiput with one small and one large bristle above middle of posterior margin composed of antennal groove. Pronotal comb composed of twenty-two spines. First seven abdominal tergites each with three rows of bristles. Apex of 7s with a conical ventral lobe.

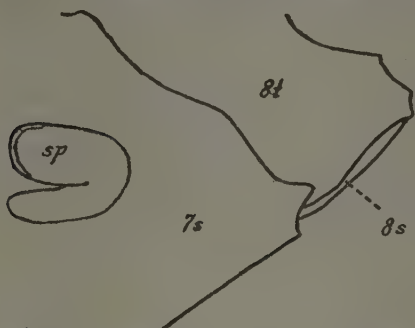


FIG. 84. *Paraceras sinensis*, female. (Author's drawing.)

8t with one strong bristle below stigma, about twenty-five bristles on lower half, and seven small bristles above stigma; apex, like that of *P. crispus*, angulate below middle. Head of spermatheca nearly as long as tail and less than twice as wide as tail, in one specimen head and tail nearly equal in length and width. A very large species, about 5 millimeters long.

6. Genus NEOCERATOPHYLLUS novum

Frontal tubercle prominent. Eyes well developed. Labial palpus reaching to base of fore trochanter. Ocular bristle located lower than upper margin of eye. Frontal row absent or rudimentary; only a few long setae before anterior margin of antennal groove. First occipital row consisting of one bristle and second row of two bristles. Bristles of second antennal segment reaching beyond middle of club in male, but very short in female. Pronotal comb present. Outer surface of fore femur with few (one to four) small lateral bristles. Inner surface of mid- and hind coxae without longish thin bristle. None of apical bristles of any tarsal segment reaching beyond apex of following segment. First pair of plantar bristles situated as laterally as other pairs.

Male.—One antepygial bristle and two minute bristles. A short median process situated between two sets of antepygial bristles. Inner side of 8t with spiculate area below dorsal margin. 8s broken up into whiplike laciniae. Process of clasper hooked at apex. Finger long, with a ventral process

bearing three spiniform bristles. Coiling of ejaculatory duct incomplete (not more than one half). Anal sternite longer than tergite.

Female.—Three antepygidial bristles. Between two sets of antepygidial bristles a longer median process below which there is a distinct sinus. Stylet with one apical and one lateral (ventral) bristle. Head of spermatheca barrel-shaped, longer and broader than tail. Bursa copulatrix normal. Genotype: *N. trispinosus* sp. nov.

This new genus belongs to Jordan's group A (1932) or Ioff's subtribe Tarsopsyllini. It differs from the allied genera in that the first pair of plantar bristles of all tarsi is not situated in between the second pair. Regarding the genitalia it is in some respects allied to *Aceratophyllus* Ewing.

20. *NEOCERATOPHYLLUS TRISPINOSUS* sp. nov. Text figs. 35 and 36.

Head.—Frontal tubercle marked. Ocular row composed of three strong bristles. Obliquely above eye four smaller bristles in male and one in female, situated along anterior margin

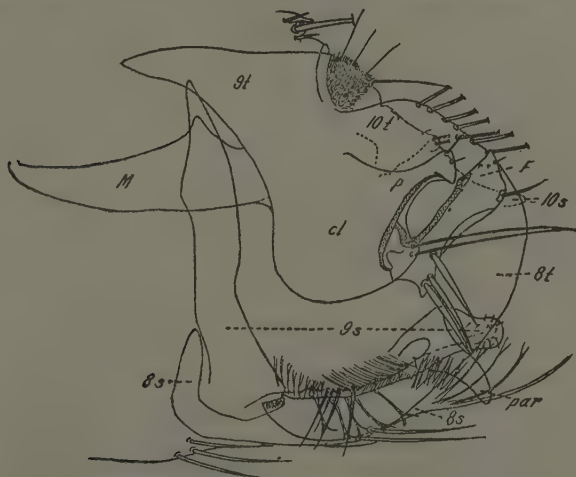


FIG. 35. *Neoceratophyllus trispinosus* sp. nov., male. (Author's drawing.)

of antennal groove. Small setae present between bristles of ocular row and along anterior (middle part) and posterior margins of antennal groove. Occiput with first row represented by one bristle, second row by two bristles, of which lower is

rather stout, an apical row of five bristles on each side. Genal process acute. The proportional lengths of the four joints of the maxillary palpus are 27, 30, 24, and 36 in male and 23, 25, 22, and 30 in female.

Thorax.—Pronotum with a submedian row of five or six bristles on each side, with small setae between them. Distance between bristles becoming gradually wider from dorsal side downwards. Pronotal comb consisting of eight spines on each

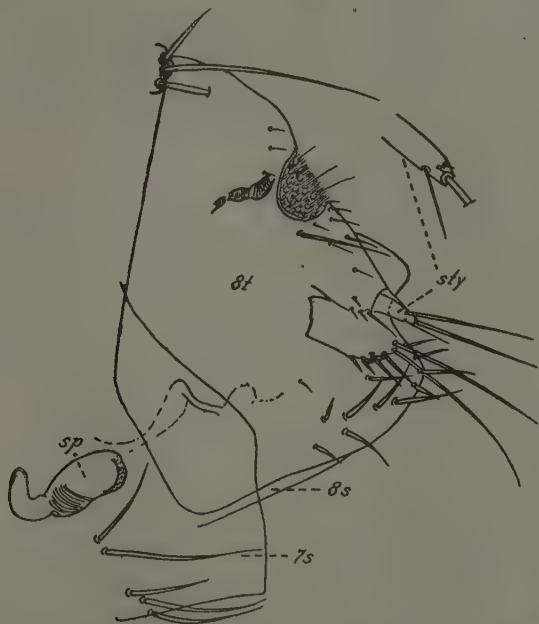


FIG. 36. *Neoceratophyllus trispinosus* sp. nov., female. (Author's drawing.)

side, lowest two spines distinctly smaller. Mesonotum with three rows of bristles: two, six or seven, five (apical row) on each side. Mesepisternum with two bristles in male and three in female. Mesepimeron with a row of three strong bristles. Metanotum with three rows of bristles: one, six to eight, five (apical row). Metepisternum with three or four bristles, metasternum with one to three very stout bristles, and metepimeron with three rows of strong bristles (two, two, one). Metanotum with a sclerotized tooth behind apical row, near dorsal margin.

Legs.—Fore femur with one to four lateral bristles (three in holotype and two in allotype) and, in addition, about seventeen small bristles in male and eleven in female, forming a dorsal and subdorsal row and a lower apical bristle. Hind tibia with eight pairs of spines along dorsal margin, second, fifth, and eighth pairs very stout. None of apical bristles of any tarsal segment reaching beyond apex of following segment.

Proportional lengths of different tarsi of all legs as follows:

	1st.		2d.		3d.		4th.		5th.	
	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
Fore tarsi	21	17	30	19	21	17	17	13	38	35
Midtarsi	43	37	40	35	23	25	19	15	38	35
Hind tarsi	97	80	68	55	45	36	24	20	44	42

Abdomen.—All tergites each with two rows of bristles, first row consisting of small bristles, apical row of strong bristles alternating with small setæ. Bristles of each row on each side of abdominal tergites as follows: first tergite 5, 5, with two apical teeth in male, and 3, 4, with one apical tooth in female; second tergite 6, 7 in male, and 5, 6 in female, with three apical teeth in both sexes and with lowest bristle of second row situated just below stigma; third tergite 5, 7 with two apical teeth in male, and 6, 6 with one apical tooth in female, in both sexes lowest bristle of second row situated below stigma; fourth tergite 5, 7, with two apical teeth in male, and 5, 6, with one apical tooth in female; fifth tergite 6, 7, with one apical tooth in male, and 5, 6, without apical tooth in female; sixth tergite 6, 7 in male and 4, 6 in female, in both sexes without apical tooth; seventh tergite 4, 7 in male, and 3, 5 in female, in both sexes without apical tooth. First two basal sternites without bristles, bristles of other sternites as follows: third sternite 2 in both sexes; fourth sternite 2 in both sexes; fifth sternite 2 in both sexes; sixth sternite 2 in male and 3 in female; seventh sternite 3 in male and 5 in female.

Modified segments.—Apex of 7*t* with a short process projecting backwards between two sets of antepygidial bristles. One long antepygidial bristle and two very minute bristles. 8*t* with a band of spiculate area below dorsal margin on inner side, seven bristles along dorsal margin, about nine bristles on subdorsal part above stigma, and nine more bristles on central or lower portion below stigma: apex rounded in outline. 8*s* rather broad, at distal apex with two ventral bristles, a fringed membranous lobe, and some filaments. Process of clasper long, dilated (hooked) at apex which bears two bristles. Two ace-

tabular bristles present. Manubrium of clasper tapering toward end. Movable finger slender, with apex slightly dilated and at lower ventral process with two stout spiniform bristles, slightly above them another spiniform bristle. The name of the species is derived from these three spinelike bristles. 9s with anterior arm tapering proximally; posterior arm terminating at a rounded membranous apex. Anal tergite slightly concave dorsally, at apex bearing a number of bristles. Anal sternite triangular, posterior angle much prolonged, with about twelve bristles on dorsal margin and a number of short bristles at apex.

Female.—Three antepygidial bristles. Process between two sets of antepygidial bristles longer than that of male, with a distinct excision below process. Apex of 7s with an upper shallow incurving and a more or less truncate lower lobe. 8t with three small bristles above stigma and one large bristle below stigma or pygidium. Apex of 8t with a deep sinus, lower lobe wider, with five spiniform bristles along apical margin and four more spiniform bristles and three bristles near apex. 8s narrow. Stylet with one apical bristle and with one lateral bristle on ventral margin. 10s distinctly angulate along ventral margin, along ventral apical margin with six strong bristles. Head of spermatheca barrel-shaped, concave above and concave below, much longer and wider than tail.

Length, male, 2.5 millimeters; female, 2.7.

Holotype, male, and allotype, female, and fifteen paratypes: Two males and thirteen females, all taken by myself off a squirrel, *Sciurus* sp., at Tien Mo Shan, Chekiang, August 17, 1936. In the author's collection.

7. Genus ACERATOPHYLLUS Ewing, 1929

Frontal tubercle marked and placed farther up. Frontal row wanting or rudimentary, few setae in front of anterior margin of antennal groove. Labial palpus reaching to apex of fore coxa or trochanter. Occiput usually with three bristles (two incomplete rows) besides apical row. Bristles of second antennal segment of female reaching almost to or a little beyond club. Fifth segment of all tarsi with basal pair of plantar bristles shifted ventrad, situated in between second pair.

Male.—One long antepygidial bristle and two small stiff hairs. 8s broken up into whiplike laciniae. Clasper with long process hooked at apex. Two strong acetabular bristles located not higher than hinge of movable finger. Finger boot-shaped, with

one bladeliike bristle near distal apex and a group of two to four very stout bristles at heel (lower ventral process). 9t extending farther frontad, sometimes beyond distal apex of manubrium. Manubrium dorsally not far from base, with a rounded hump. Apex of 9s with a knifelike bristle.

Female.—Three antepygidial bristles. Head of spermatheca barrel-shaped or somewhat globular.

When Ewing established this genus in 1929, he took as the genotype *A. javanicus* Ewing which, unfortunately, was regarded by Jordan as a species of *Paraceras*. I am of the opinion that *A. fimbriatus* (Jordan et Rothschild, 1921), should be designated as the genotype, and am inclined to include three other species into this genus: *A. lupatus* (Jordan et Rothschild, 1921), *A. euteles* (Jordan et Rothschild, 1911), and *A. phillipsi* (Jordan, 1925). In order to meet the present situation the description of the genus has been greatly modified. This genus is closely related to *Macrostylophora* Ewing, 1929, which was erected for *C. hastatus* Jordan et Rothschild, 1921. It can be distinguished from the above genus by the absence of the median process between the antepygidial bristles and the presence of a bladeliike bristle near the apex of the ninth sternite.

21. *ACERATOPHYLLUS EUTELES* (Jordan et Rothschild, 1911). Text figs. 37 and 38.

Frontal tubercle marked, nearer to central sensory organ than to oral angle. Frontal row composed of one to three small bristles. Labial palpus reaching to apex of fore coxa. Pronotal comb consisting of eighteen spines. Meso- and metanota each with two rows of bristles and a few additional dorsal bristles forming a third row. Longest apical bristle of second hind tarsal segment one-third shorter than third segment.

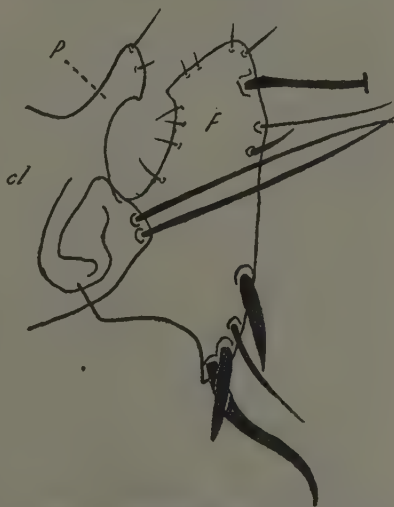


FIG. 37. *Aceratophyllus euteles*, male. (After Jordan.)

Male.—Process of clasper dilated at apex with a sharp lower angle. Finger peculiar in shape (text fig. 37); dorsal apex

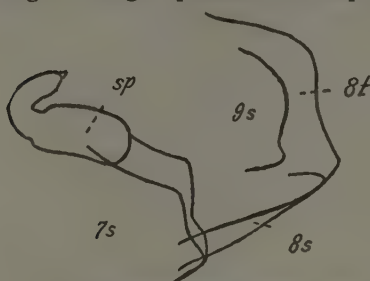


FIG. 88. *Aceratophyllus euteles*, female. (After Jordan and Rothschild.)

truncate, ventral apex concave; stout spiniform bristles present, long and wavy.

Female.—Apical margin of 7s either slightly incurved or slanting. 8t with one long and two short bristles below stigma, seven to ten bristles in ventral half; apex gently incurved, upper angle rounded. Head cylindrical, longer than tail.

8. Genus PARADOXOPSYLLUS Miyajima et Koidsumi, 1909

The original description of the genus was apparently lost and unknown to the world until 1934. It was written in Japanese and published in the Journal of Bacteriology. When Miyajima and Koidsumi first established the genus they gave the following generic characters: (a) incomplete pigmentation of eye, (b) one acetabular bristle (with exceptions at present), (c) presence of pronotal comb, and (d) five pairs of plantar bristles. At present other characters are shown to be of generic importance: frontal tubercle frequently wanting; labial palpus not reaching beyond fore trochanter; ocular bristle situated above eye on margin of antennal groove; bristles on second antennal segment not long in male; prefrontal row of bristles wanting; only a vestigial occipital row of bristles; first hind tarsal segment shorter than second, third, and fourth segments combined; first pair of plantar bristles of fifth hind tarsal segment situated laterally, like others.

Male.—One or both outer two of the three antepygidial bristles minute or wanting. 8s large and wide.

Female.—Spermatheca with a globose head and a saclike tail.

Key to the species of *Paradoxopsyllus*.

1. Longest apical bristle of second hind tarsal segment reaching to middle of fifth segment or projecting beyond fifth segment. Male, one acetabular bristle. Finger widest at middle, tapering towards apex. 8t with a lateral patch of sixteen to eighteen strong bristles. Female, apex of 7s with a slightly excurved lobe..... 2.
- Longest apical bristle of second hind tarsal segment reaching to apex of third segment or a little beyond third segment. Male, two acetabular

bristles. Finger of even width. 8t without lateral patch of long bristles. Female, apex of 7s with a distinct small sinus.

P. custodis Jordan.

2. Frontal tubercle marked. No hairs above antennal groove. Middle tergites each with a posterior row of five or six bristles on each side.

P. curvispinus Miyajima et Koidsumi.

Frontal tubercle feebly developed. Some hairs above antennal groove and some in form of shortened bristles. Middle tergites each with a posterior row of seven bristles..... *P. conveniens* Wagner.

22. PARADOXOPSYLLUS CURVISPINUS Miyajima et Koidsumi, 1909. Text figs. 39 and 40.



FIG. 39. *Paradoxopsyllus curvispinus*, male, variations. (A, After Miyajima and Koidsumi; B, after Rothschild.)

Front vertical from tubercle downward. Eye round, very feebly pigmented. Frontal row of three or four bristles. Bristles of second antennal segment minute in both sexes. Labial palpus extending to fore trochanter. Occiput with one stout bristle behind middle of antennal groove. Pronotal comb composed of eighteen pointed spines. Longest apical bristle of second hind tarsal segment (one in female and three in male) extending to middle of fifth segment or beyond; third segment of male about twice as long as fourth segment. Middle abdominal tergites bearing each a posterior row of five or six (mostly six) large bristles.

Male.—Two antepygidial bristles, upper bristle about one-half as long as middle

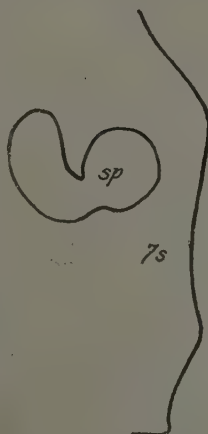


FIG. 40. *Paradoxopsyllus curvispinus*, female. (After Rothschild.)

bristle. 8s rather large, not very much smaller than tergite, produced ventrally into a pointed lobe bearing one to four bristles, besides a dozen smaller bristles. Manubrium of clasper terminating in a slender point. Dorsal posterior portion of clasper forming a broad process. Finger thumblike, widest at middle, strongly rounded along posterior margin. One long acetabular bristle. 9s exceedingly slender, posterior arm bearing two long bristles near middle.

Female.—Three antepygidial bristles, lowest bristle shortest. Apex of 8s more or less truncate in outline, except two slight incurvings. Apical margin of 8t rounded and slightly undulate, with lower angle projecting. Stylet about twice as long as basally broad. Spermatheca with globular head and broad tail.

23. PARADOXOPSYLLUS CUSTODIS Jordan, 1932. Text figs. 41 and 42.

Closely allied to *P. curvispinus* Miyajima et Koidsumi. Frontal row composed of six (in male and two in female) bristles.



FIG. 41. *Paradoxopsyllus custodis*, male. (After Jordan.)

Occiput with three bristles behind middle of antennal groove. Hind tibia with nine dorsal notches, third, sixth, and seventh of which bear one bristle each; longest dorsal apical bristle of hind tibia not extending to apex of first hind tarsal segment; longest bristle of first segment extending to subapical notch of second segment, longest apical bristles of second segment reaching to apex of third segment or a little beyond. Middle abdominal tergites bearing each a posterior row of five or six bristles.

Male.—8t with three or four small bristles above stigma and two very long bristles below, without a lateral patch of long

bristles. Clasper more than twice as long as broad at narrowest point, rounded ventroposteriorly and enlarged into a broad process. Manubrium slender. Angle between inner frontal portion of 9t and manubrium very obtuse. Two acetabular bristles, long upper bristle shifted well above acetabulum, lower bristle much smaller. Finger of even width, strongly curved at base, apex obliquely truncate on anterior side. Frontal margin of proximal apex of anterior arm of 9s concave; apical lobe of posterior arm round at apex, irregularly long-ovate.

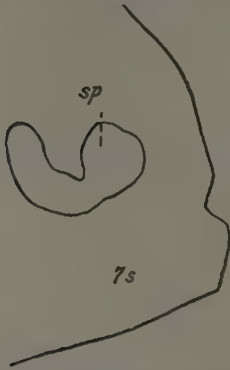


FIG. 42. *Paradoxopsyllus custodis*, female. (After Jordan.)

Female.—7s with a small sinus below middle of apical margin. 8t with two or three bristles above

stigma, one long and one small bristle below stigma, eight or nine on lower area and two or three inside, of which one is marginal. Spermatheca with a subglobular head and a long tail. Duct of bursa copulatrix strongly curved in middle, bursa rather large.

24. PARADOXOPSYLLUS CONVENIENS Wagner, 1929.

Female.—Frontal tubercle feebly developed. On upper margin of antennal groove six or seven hairs, hind one or two of which are in the form of shortened bristles. Longest dorsal apical bristle of hind tibia extending beyond apex of first hind tarsal segment; longest bristle of first segment extending beyond apex of second segment; two apical bristles of second segment extending to middle of fifth segment or beyond. Middle abdominal tergites bearing each a posterior row of seven large bristles. Apical margin of 7s bearing a small evagination. 8t bearing below stigma two or three stout bristles, one to three smaller bristles, and, apart from marginal bristles, nine to eleven lateral bristles.

9. Genus OPTHALMOPSYLLA Wagner et Ioff, 1926

Frontal tubercle small. Labial palpus not reaching beyond fore trochanter. Ocular bristle situated above upper margin of eye. Prefrontal row wanting. Eye very peculiar in that it consists of a larger, upper, lightly pigmented portion and a

smaller, lower, deeply pigmented portion which appears as an appendage or a second eye to upper eye. This second eye smaller in male. Upper eye often provided with a sinus which is more pronounced in male. Bristles of second antennal segment in female not long. Antepygidial bristles three in both sexes, spinelike in male.

Male.—Posterior margin of clasper with an acetabular projection on which is a very stout bristle. 8s feebly developed.

Female.—Head of spermatheca pyriform, narrowing toward distal end.

Key to the species of Ophthalmopsylla.

1. Frontal tubercle normal in shape and position. First hind tarsal segment shorter than second to fourth segments together..... 2.
Frontal tubercle rounded and close above oral corner. First hind tarsal segment equalling second to fourth segments together. Finger with blunt spiniform *O. jettmari* Jordan.
2. Longest apical bristle of second hind tarsal segment extending to apex of fourth. Male, apical half of finger nearly square, with two normal spiniforms at posterior angle. Acetabular projection not very narrow. Female, apex of 7s with a broad, shallow upper sinus.

O. kukuschkini Ioff.

Longest apical bristle of second hind tarsal segment extending beyond apex of fourth. Male, apical half of finger nearly ax-shaped, with a twisted spiniform at posterior angle. Acetabular projection narrow. Female, apex of 7s with a deep lower sinus..... 3.

3. Pronotal comb consisting of eighteen to twenty spines. Metepimeron with seven or eight bristles. Male, finger resembling an inverted bell, with twisted spiniform. Female, apex of 7s with a semicircular sinus, upper lobe rounded, lower lobe pointed..... *O. praefectus pernix* Jordan.
Pronotal comb composed of twenty-four or twenty-five spines. Metepimeron with twenty-three bristles arranged in five vertical rows. Male unknown. Female, apex of 7s with an elongate semicircular sinus, upper lobe sharply pointed, lower lobe more or less truncate.

O. kiritschenkoii Wagner.

25. *OPHTHALMOPSYLLA PRAEFECTUS PERNIX* Jordan, 1929. Text figs. 43 and 44.

Front with a row of five small bristles above an ocular row of three strong bristles. Labial palpus reaching to fore trochanter but not beyond it, a little longer than maxillary palpus. Eye with black-pigmented inside deeply sinuated. Bristles of second antennal segment short in both sexes. Pronotal comb composed of eighteen to twenty spines. Metepimeron with seven or eight bristles. Second hind tarsal segment in male with two, in female with three, long apical bristles reaching beyond apex of fourth segment. Proximal pair of plantar bristles of all tarsi entirely lateral.

Male.—Clasper with dorsal portion produced into a slender process; lower angle also produced into a short process which bears a long acetabular bristle. Finger shaped like an inverted



FIG. 43. *Ophthalmopsylla praefectus perniz*, male. (After Jordan.)



FIG. 44. *Ophthalmopsylla praefectus perniz*, female. (After Jordan.)

bell, widest at apex; anterior apical angle bearing a short pale spine, posterior apical angle bearing a strong twisted pointed spiniform below, close to which is a subspiniform.

Female.—Apex of 7s with a rounded, rather deep sinus. 8t below stigma with two long and three or four short bristles. Stylet a little more than twice as long as broad at base. Spermatheca with a pyriform head about as long as tail.

26. *OPHTHALMOPSYLLA KUKUSCHKINI* Ioff, 1927. Text fig. 45.

Resembles somewhat *O. praefectus* Jordan et Rothschild. Longest apical bristle (ventral) of second hind tarsal segment reaching only to apex of fourth segment, dorsal bristle just exceeding apex of third segment.

Male.—Upper process of clasper rounded off at apex; lower acetabular projection not so narrowed as in *praefectus*. Finger



FIG. 45. *Ophthalmopsylla kukuschkini*, male. (After Ioff.)

with distal half more or less square, anterior margin more or less straight, hind margin gradually convex, two apical corners not acute, spiniforms not twisted. 9s with a row of stout bristles along centro-ventral margin of posterior arm.

Female.—Apex of 7s with a broad shallow upper sinus, angle above sinus very obtuse and strongly rounded, lobe below sinus projecting out considerably, broad, apically emarginate, with upper angle strongly rounded.

27. *OPHTHALMOPSYLLA JETTMARI* Jordan, 1929. Text figs. 46 and 47.

Frontal tubercle rounded. Pronotal comb with twenty-four or twenty-five spines. Eighteen to twenty-six bristles on met-



FIG. 46. *Ophthalmopsylla jettmari*, male. (After Jordan.)

epimeron. Metanotum bearing on each side three or four blackish apical spines. First hind tarsal segment equaling second to fourth segments together. Longest dorsal bristle of second hind tarsal segment in male reaching to, or beyond, apex of fifth segment, and in female reaching not quite to apex of fourth segment.

Male.—8t with forty bristles below stigma. Upper process of clasper stout and truncate at apex; lower acetabular projection short, cylindrical, bearing a long bristle. Finger a little more than twice as long as broad; anterior apical angle 90° ; posterior apex widened into a convex lobe, above which is a

claviform or blunt spiniform. Posterior arm of 9s with a double row of ten long bristles.

Female.—Apical margin of 7s slanting, with a broad shallow oblique sinus below which the segment is subtruncate. Spermatheca resembling that of *O. præfectus*; sclerified portion of bursa copulatrix elbowed.

28. *OPHTHALMOPSYLLA KIRITSCHENKOI*
Wagner, 1929. Text fig. 48.

Female.—Frontal row consisting of three lower bristles. Bristles of second antennal segment small. First occipital row either entirely missing or replaced by a small bristle. Pronotal comb consisting of twenty-four or twenty-five spines. Metepimeron with about twenty-three bristles arranged in five irregular rows. Outer surface of hind tibia provided with twenty-six to twenty-nine bristles, of which posterior eighteen form two complete rows. Two apical bristles of second hind tarsal segment reaching beyond apex of fourth segment. Apical margin of 7s with a deep sinus dividing apex into a long, narrow acute upper lobe and a short, blunt, lower lobe. 8t bearing about twenty-three substigmatal bristles which form three rows; before and above stigma are dense small bristles. Stylet short, conical.



FIG. 47. *Ophthalmopsylla jettmari*, female.
(After Jordan.)

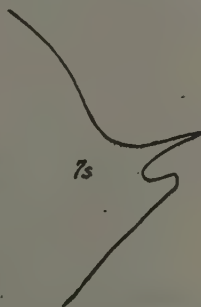


FIG. 48. *Ophthalmopsylla kiritschenkoii*, female.
(After Wagner.)

10. Genus *FRONTOPSYLLA* Wagner et Ioff, 1926

Frontal tubercle conical. Lower portion of front slightly prolonged or extended behind. Frontal row complete. Prefrontal row wanting. Ocular row composed of three or four bristles. Ocular bristle situated above eye on margin of antennal groove. Sometimes a bristle between frontal and ocular row. Bristles of second antennal segment not long in male. Labial palpus

not lengthened, not reaching beyond trochanter. Two occipital rows of bristles well developed; second row always complete. First hind tarsal segment shorter than second, third and fourth segments combined. First pair of plantar bristles on fifth tarsi situated laterally, like other pairs. Antepygidial bristles three in both sexes, one or two of those of male minute or wanting.

Male.—8t short, length deeply broken behind. 8s broad. Upper acetabular bristle shifted considerably upward.

Female.—No distinct boundary between head and tail of spermatheca.

Key to the species of Frontopsylla.

1. Pronotal comb composed of twenty-four spines. Female, apex of 7s not sinuate *F. hetera* Wagner.
 Pronotal comb composed of eighteen to twenty spines. Female, apex of 7s distinctly sinuate 2.
2. Ocular row composed of four bristles, one less developed. Middle abdominal tergites with three more or less developed rows of bristles. Male, posterior and apical margins of finger evenly rounded in form of a semicircle. Female, apex of 7s with a wide sinus.
F. wagneri Ioff.
 Ocular row composed of three bristles. Middle abdominal tergites with two rows of bristles, although few frontal small bristles may be present. Male, posterior margin of finger slightly incurved, apical margin more or less truncate. Female, apex of 7s with a narrow sinus..... 3.
3. Longest apical bristle of second hind tarsal segment reaching beyond third segment in female and beyond fourth segment in male. Male, process of clasper long, apex reaching beyond middle or even beyond apex of finger. Posteroapical spiniform of finger short, blunt, often widest at center. 8s not bearing four spiniform bristles at apex..... 4.
- Longest apical bristle of second hind tarsal segment not reaching beyond apex of third segment in female. Male, process of clasper very short, apex not reaching beyond middle of finger. Posteroapical spiniform of finger long, acute, widest at base. 8s bearing four spiniform bristles besides other bristles at apex..... 6. *F. spadix* Jordan et Rothschild.
4. Male, process of clasper relatively short, reaching three-fourths length of anterior margin of finger. Setose ventral area of 9s with a spiniform placed nearer distal bristle. Female, apex of 7s with a sinus which is much wider than lower lobe..... *F. elata botis* Jordan.
 Male, process of clasper long, either reaching to nine-tenths length of anterior margin of finger or projecting beyond latter. Setose ventral area of 9s with a spiniform about midway between proximal and distal bristles. Female, apex of 7s with a sinus as wide as lower lobe.
 5. *F. luculenta* Jordan et Rothschild.
5. Male, process of clasper located a little below anterior apex of finger.
F. luculenta luculenta Jordan et Rothschild.
 Male, process of clasper a little above anterior apex of finger.
F. luculenta parilis Jordan.

6. Male, posteroapical spiniform of finger shorter. Apex of finger a little narrower. Female, apex of 7s with a shallow sinus, upper lobe broader than lower..... *F. spadix spadix* Jordan et Rothschild.
 Male, posteroapical spiniform of finger longer. Apex of finger one-sixth or one-seventh wider. Female, apex of 7s with a deeper sinus, upper lobe narrower than lower..... *F. spadix cansa* Jordan.

29. *FRONTOPSYLLA ELATA BOTIS* Jordan, 1929. Text figs. 49 and 50.

Allied to *F. elata elata* (Jordan et Rothschild, 1915), which is characterized by the following description: Frontal row composed of six to eight bristles. Ocular row composed of three bristles. Two occipital rows of bristles (four, six) and an apical row of six bristles. Pronotal comb consisting of nineteen or twenty spines. Metepimeron with four to six long bristles. Longest apical bristle of second hind tarsal segment



FIG. 49. *Frontopsylla elata botis*, male. (After Jordan.)

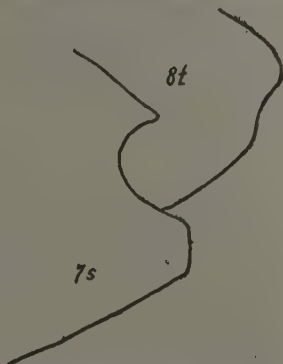


FIG. 50. *Frontopsylla elata botis*, female. (After Jordan.)

reaching beyond apex of fourth segment in male, shorter in female. Middle abdominal tergites with only two rows of bristles, sometimes a few frontal bristles present.

Male.—8t with nineteen to twenty-four bristles. 8s large, conical in outline, with a number of bristles at apical portion. Process of clasper acuminate at apex, slightly shorter than frontal margin of finger. Finger widest at apex which is more or less truncate, with a spiniform at distal apical angle. Proximal apex of 9s rectangular; 9s without an excision beyond setiferous area, with one short spiniform at distal end of setose area; hind margin of posterior arm of 9s almost straight. Anal tergite bearing two small spiniforms and several apical spines. 8t bearing long bristles, alternating with shorter and thinner bristles. Process of clasper shorter, apex located about one-

fourth distance below apex of finger. Apical margin of finger shorter, posterior margin but slightly incurved.

Female.—Apex of 7s with a sinus dividing it into an upper pointed lobe and a broad lower, rounded-truncate lobe, upper lobe as long as lower lobe. Spermatheca truncate, head about one-third longer than broad. 7s resembling *F. elata elata*, except that the lower lobe is rather convex. "Below stigma of VIII. t. 1 long bristle and 1-3 short ones; on the widened lower and apical portion 14-19 bristles, there being a wide gap between these bristles and those below the stigma."

Frontopsylla elata botis differs from the preceding subspecies especially in the male.

30a. *FRONTOPSYLLA LUCULENTA LUCULENTA* (Jordan et Rothschild, 1923). Text figs. 51 and 52.

Frontal row composed of five to seven bristles, ocular row composed of three bristles. Occiput with two rows of bristles

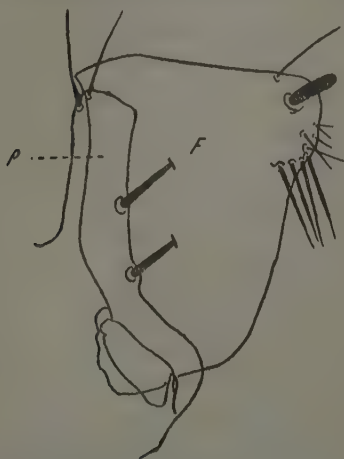


FIG. 51. *Frontopsylla luculenta luculenta*, male.
(After Jordan and Rothschild.)



FIG. 52. *Frontopsylla luculenta luculenta*, female. (After Jordan and Rothschild.)

(four or five, five or six) besides apical row. Pronotal comb composed of twenty spines. Mesonotum with four rows of bristles, metanotum with three rows of bristles. Metepimeron with three rows of bristles (four, five, one or two). Longest apical bristles of second hind tarsal segment reaching beyond apex of fourth segment in male and third segment in female.

Male.—8s even more bristly than *F. elata elata*, there being numerous long submarginal and marginal bristles besides small

ones. Process of clasper broader, truncate at apex. Inner surface of finger also fringed with hairs. Hind margin of posterior arm of 9s much convex, setose posterior area with a short spiniform about midway between most proximal and most distal spiniform.

Female.—Apex of 7s with a deep sinus dividing it into an upper pointed lobe and a broad, lower rounded-truncate lobe, upper lobe considerably shorter than lower. Spermatheca with tail a little shorter than that of *F. elata elata*.

30b. *FRONTOPSYLLA LUCULENTA PARILIS*
Jordan, 1929. Text fig. 53.

Apparently differing from *F. luculenta luculenta* only in male. Process of clasper longer, reaching a little above, or to anterior apical angle of movable finger.

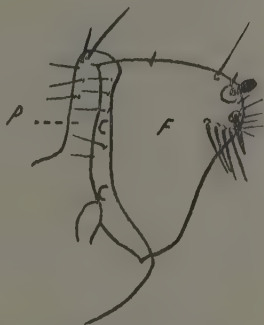


FIG. 53. *Frontopsylla luculenta parilis*, male. (After Jordan.)

31. *FRONTOPSYLLA WAGNERI* Ioff, 1927. Text figs. 54 and 55.

Frontal row composed of six to eight bristles. Ocular row composed of four bristles, fourth bristle set between the two lower bristles and less developed. Occiput with two rows of bristles (four to seven, six or seven), apex with one row. Pronotal comb composed of eighteen to twenty spines. Middle abdominal segments with three more or less developed rows of bristles, being more bristly than *F. elata* and *luculenta*.

Male.—Process of clasper rather short, about one-half as long as finger, rounded at apex. Finger much longer than process, crescent in outline with posterior margin strongly rounded; a spiniform present a little beyond middle of posterior margin from base. Posterior arm of 9s weakly developed, with few small bristles on posterior margin, short spiniform lacking.

Female.—Apex of 7s with a very wide sinus dividing it into an upper pointed lobe and a lower rounded or truncate lobe,

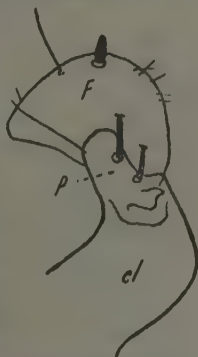


FIG. 54. *Frontopsylla wagneri*, male. (After Ioff.)

sinus much wider than lower lobe. Spermatheca similar to that in the preceding species.

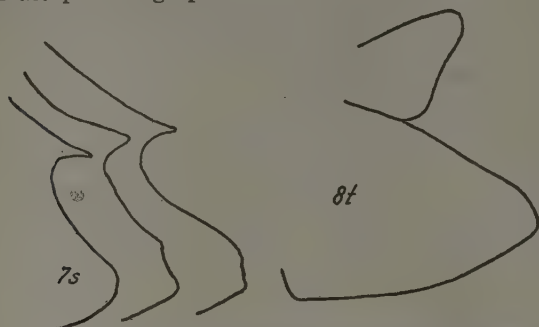


FIG. 55. *Frontopsylla wagneri*, female, variations of seventh sternite. (After Ioff.)

32. *FRONTOPSYLLA HETERA* Wagner, 1932. Text fig. 56.

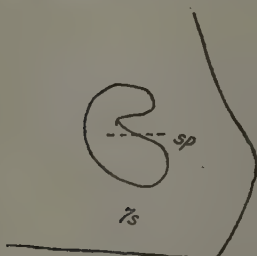


FIG. 56. *Frontopsylla hetera*, female. (After Wagner.)

Female.—Occipital rows consisting of four to six bristles. Pronotal comb composed of twenty-four spines. Pronotum as long as spine. Two apical bristles of second hind tarsal segment reaching to middle of fourth segment. Lowest bristle on fourth to seventh abdominal tergites considerably weaker than rest, situated below stigma on fourth to sixth abdominal tergites, above stigma on seventh. Apex of 7s more or less rounded-truncate. 8t with one long bristle below stigma and seven long bristles at lower apical portion. Stylet narrower.

33a. *FRONTOPSYLLA SPADIX SPADIX* Jordan et Rothschild, 1921. Text fig. 57.

Frontal row composed of six bristles, ocular row of three bristles. Occiput with two rows of bristles (two, six) and an apical row of seven bristles. Pronotal comb composed of twenty spines. Meso- and metanota with three rows of bristles. Metepimeron with seven or eight bristles. Longest bristle of second hind tarsal segment not reaching beyond apex of third segment. Apical margin of first to fourth abdominal segments dorsally denticulate.

Male.—Genitalia similar to those in *F. spadix cansa*. Apex of 8s with four stout spiniforms. Process of clasper short,

reaching to a little below middle of finger. Manubrium broad at base, abruptly narrow towards apex. Finger resembling an inverted bell in outline, with a narrow base; anterior margin evenly concave; apical margin evenly convex; a stout spiniform at posterior apical angle; both anterior and posterior apical angles acute or less than 90° . Proximal apex of anterior arm of 9s in the shape of a goose head.

Female.—Apex of 7s with a shallow sinus dividing it into two broadly rounded lobes, upper lobe broad, lower lobe rounded. 8t with six to eight small bristles above stigma, one large and two to four small bristles below stigma. Spermatheca with elongate head and short broad tail.

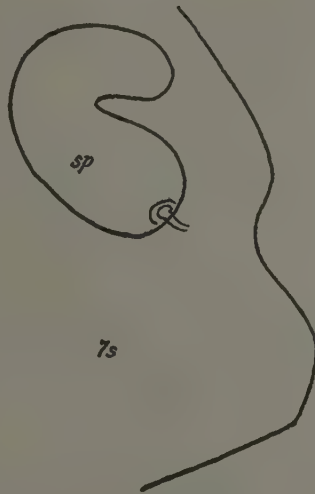


FIG. 57. *Frontopsylla spadix spadix*, female. (After Jordan and Rothschild.)

33b. *FRONTOPSYLLA SPADIX CANSA* Jordan, 1932. Text figs. 58 and 59.

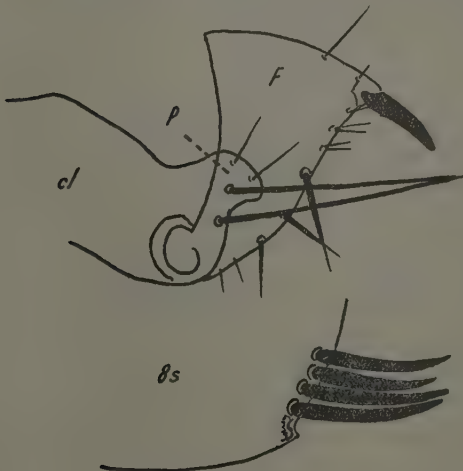


FIG. 58. *Frontopsylla spadix cansa*, male. (After Jordan.)

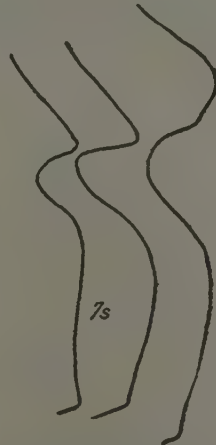


FIG. 59. *Frontopsylla spadix cansa*, female, variations of seventh sternite. (After Jordan.)

Closely related to *F. spadix spadix*. Male, finger apically about one-sixth to one-seventh wider, large apical spiniform longer. Female, sinus of 7s deeper; upper lobe longer, often pointed at apex, lower lobe much broader than upper.

11. Genus GEUSIBIA Jordan, 1932

Frontal tubercle prominent. Ocular row composed of three bristles. Labial palpus reaching to near two-thirds length of fore coxa in male, five-sixths in female. Tibia and first tarsal segment of all legs densely hairy on dorsal margin besides bearing long bristles. First pair of plantar bristles of fifth tarsal segment distinctly bent mediad. Antepygidial bristles, none in male and three in female. 7t bearing median process which is short in female and long in male, here reaching a little beyond middle of pygidium.

Male.—Both 8t and 8s large, former conical, without a row of marginal bristles; 8t dorsolaterally with an elongate horizontal sclerite which bears a condylus; 8s with two rodlike incrassations on each side. Process of clasper broad, conical, and as long as finger. Apex of anterior arm of 9s broad, truncate-emarginate, with upper and frontal angles distinctly projecting.

Female.—Orifice of spermatheca on a prominent cone projecting downwards.

34. GEUSIBIA TOROSA Jordan, 1932. Text figs. 60 and 61.

Frontal row composed of five or six bristles. Occiput with three rows of bristles. Pronotal comb composed of twenty to

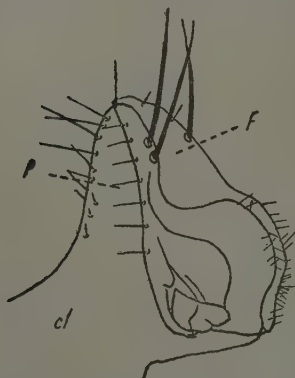


FIG. 60. *Geusibia torosa*, male. (After Jordan.)

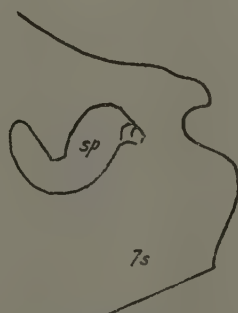


FIG. 61. *Geusibia torosa*, female. (After Jordan.)

twenty-two spines. Mesonotum with one short stout apical spine on each side. First abdominal tergite with three rows and some additional dorsal bristles, the other tergites with two rows.

Male.—8t forming an equilateral triangle with apex rounded off and bearing fifteen long bristles on side. 8s with a vertical proximal margin provided with rodlike incrassations in the form of an equilateral triangle; ventral margin gently rounded; apical margin subtruncate, bearing five spiniforms and a proximal patch of fifteen very short, obtuse conical spiniforms. Process of clasper broad, conical, as long as finger; lower half of posterior margin of clasper and finger feebly sclerotized and hairy. Apex of anterior arm of 9s broad, truncate-emarginate, with upper and frontal angles distinctly projecting; ventral process resembling head of a bird and bearing several small hairs and one bristle.

Female.—7s with sinus dividing it into a narrow, pointed upper lobe and a broad, rounded lower lobe. On 8t above stigma four to seven small bristles, below stigma three large bristles (rarely two), on lower surface eleven to fifteen, on inside two or three, apex of 8t sinuate. 8s broad. Head of spermatheca not sharply divided from tail.

12. Genus AMPHIPSYLLA Wagner, 1908

Head with an angle under which it is extended toward the posterior side. Eye feebly developed, incompletely pigmented. Ocular bristle situated above upper margin of eye. Ocular row composed of two, seldom three, bristles. Frontal row complete. Bristles of second antennal segment short in both sexes. First hind tarsal segment shorter than second, third, and fourth segments combined. First pair of plantar bristles on fifth hind tarsal segment moved on to ventral surface, almost between second pair. Between long middle bristle and long apical bristle on hind margin of hind tibia three or four short, approximately equal bristles forming a comb. Three antepygial bristles present in both sexes. Male, 8s wide. Clasper without acetabular bristles. Finger with spiniforms.

Key to the species of Amphipsylla.

1. Male, finger widest near middle, apex tapering towards end. 8s densely hairy, hairs on inner side of margin thin and wavy, those on outer side longer and thicker..... *A. casis* Jordan et Rothschild.

- Male, finger widest at apex which is more or less rounded-truncate. 8s less hairy 2.
2. Male, finger with a spiniform near base at ventroposterior corner. Female, apex of 7s truncate..... *A. tuta* Wagner.
- Male, finger without spiniform near base. Female, apex of 7s not truncate 3.
3. Male, finger with two apical spiniforms close together, none of spiniforms abruptly widest at center. 9s widening abruptly at apex. Female, apex of 7s distinctly notched..... *A. vinogradovi* Ioff.
- Male, finger with two apical spiniforms far apart along posterior margin, upper spiniform abruptly widest at center. Female, apex of 7s either rounded or very slightly sinuate..... 4.
4. Male, finger much longer and narrower; five thin marginal bristles between apical and submedian spiniforms. Posterior margin of clasper not sinuate. Female, apex of 7s rounded-convex.... *A. aspalacis* Jordan.
- Male, finger shorter and wider; eight or nine thin marginal bristles between apical and submedian spiniforms. Posterior margin of clasper sinuate. Female, apex of 7s slightly concave..... *A. mitis* Jordan.

35. AMPHIPSYLLA TUTA Wagner, 1929. Text fig. 62.

Frontal tubercle lacking. First occipital row with one bristle, second with three bristles. Lower part of front in female distinctly slanting downward and rounded off toward apex, that in male rounded off from edge of mouth to base of antenna.

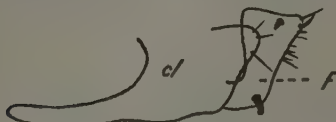


FIG. 62. *Amphipsylla tuta*, male. (After Wagner.)

Male.—8s bearing a pair of cylindrical processes, each of which has a long apical bristle. Clasper somewhat square in outline. Manubrium gradually tapering toward apex. Finger widest at apex, with a basal

spiniform at ventroposterior corner, about eight bristles along upper posterior margin, one curved bristle on upper posterior apex, another small spiniform situated a little below apical margin.

Female.—Apex of 7s truncate.

36. AMPHIPSYLLA ASPALACIS Jordan, 1929. Text figs. 63 and 64.

First occipital row composed of one bristle. Three rows on mesonotum with additional dorsal bristles. Two rows on metanotum. Metepimeron with ten to thirteen bristles in male and twelve to sixteen in female.

Male.—Apex of 8s with long bristles. Clasper not square in outline. Finger widest at apex, upper anterior angle very obtuse; spiniform located on upper posterior angle of finger widest at center, another spiniform of ordinary type above



FIG. 63. *Amphipsylla aspalacis*, male.
(After Jordan.)

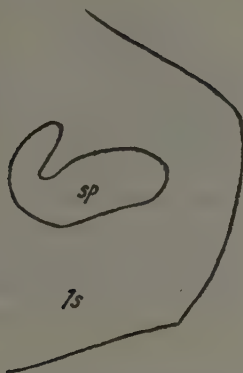


FIG. 64. *Amphipsylla aspalacis*, female.
(After Jordan.)

middle of posterior margin; between these two marginal spiniforms five thin marginal bristles; below apical margin an oblique row of three, of which the first and third are spiniform, the middle one being a bristle; a subspiniform bristle on posterior apex. Distal apex of 9s with a curved thick bristle.

Female.—Apex of 7s rounded-convex. 8t with one long bristle below stigma and two to four small bristles on widened area twenty-three to twenty-six on outside and three or four on inside. Head of spermatheca a little longer than tail, distinctly separated from it.

37. AMPHIPSYLLA CASIS Jordan et Rothschild, 1911. Text figs. 65 and 66.

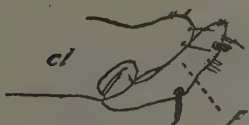


FIG. 65. *Amphipsylla casis*, male.
(After Jordan and Rothschild.)

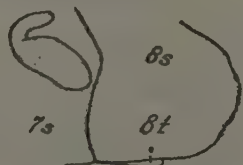


FIG. 66. *Amphipsylla casis*, female.
(After Jordan and Rothschild.)

First occipital row composed of one bristle. Metasternum with only one long bristle which is occasionally accompanied by a minute seta. Metepimeron with seven bristles (two, three, two).

Male.—8s densely hairy, longest hair longer than 8s. Clasper elongate, upper margin distinctly incurved. Manubrium slightly dilated before middle along posterior margin. Finger widest at

middle, narrowing to apex and provided with two spiniforms, one below apex, the other at middle. Apical third of 9s very narrow, top more strongly sclerotized and bearing a short, proximally thick, terminal bristle on each side.

Female.—Apex of 7s slightly incurved. Head of spermatheca about twice as long as tail.

38. AMPHIPSYLLA MITIS Jordan, 1929. Text figs. 67 and 68.

First occipital row composed of one long bristle. Metepimeron with six or seven bristles (two, three or four, one).

Male.—Clasper somewhat rectangular in outline, posterior margin sinuate. Finger widest at apex; apical margin more



FIG. 67. *Amphipsylla mitis*, male.
(After Jordan.)



FIG. 68. *Amphipsylla mitis*, female. (After Jordan.)

or less truncate; upper posteroapical spiniform curved and widest at center; median spiniform of hind margin placed low, about middle; between these two marginal spiniforms a marginal row of eight or nine bristles; one lateral spiniform situated in center of apical portion of finger, above it two bristles of which one is subspiniform.

Female.—Fourth, fifth, and sixth sternites with median vertical incassation, strongest in fourth. 7t with posterior margin slightly incurved, upper angle strongly rounded, portion below antepygidial bristles somewhat dilated. Apex of 7s slightly concave. On lower widened area of 8t eighteen bristles on outside, two of these apical. Head of spermatheca rather strongly convex dorsally and concave ventrally, little longer than tail.

39, *AMPHIPSYLLA VINOGRADOVI* Ioff, 1927. Text figs. 69 and 70.

First occipital row with one bristle.

Male.—8s bearing eight to ten thick bristles at apex. Clasper elongate, dorsal margin sinuate. Manubrium tapering towards apex. Finger widest at apex which is rounded off, with two submarginal spiniforms near posterior apex; posterior margin divided into three subequal portions by two rather thick bristles; between these two thick bristles five thin bristles. Apex of 9s widening toward end and bearing four bristles.

Female.—Apex of 7s with a distinct small notch below middle.



FIG. 69. *Amphipsylla vinogradovi*, male.
(After Ioff.)

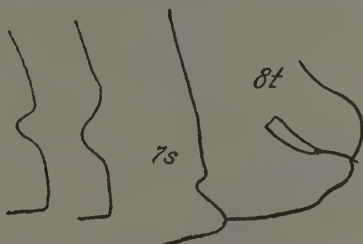


FIG. 70. *Amphipsylla vinogradovi*, female, variations of seventh sternite. (After Ioff.)

Subfamily CTENOPHTHALMINÆ Rothschild, 1915

Head with genal comb which is horizontal and composed of three nearly equal spines. Eyes rudimentary. Antennal groove closed, at least in female. Three antepygial bristles in both sexes. Only one genus of this family known from China.

13. Genus CTENOPHTHALMUS Kolenati, 1857

Frontal tubercle present. Eyes feebly developed, almost unpigmented. Genal comb composed of three spines. Labial palpus 5-jointed, last joint with a sickle-shaped apical bristle. Frontal row complete. Ocular row consisting of three bristles. Antennal groove closed, especially in female. First occipital row composed of two separated parts in male, second row represented by one bristle. Fifth hind tarsal segment with three pairs of lateral plantar bristles and a proximal pair on ventral surface in between first lateral pair. Hind coxa without patch of spinelets on inner side. Three antepygial bristles in both sexes. Finger with small sensory cones in male.

Key to the species of *Ctenophthalmus*.

1. Sixth and seventh abdominal tergites with one row of bristles. Process of clasper divided by a sinus into a broad, round, anterior portion and

a narrow, conical, posterior portion. Apex of finger not distinctly sinuate *C. yunnanus* Jordan.

Sixth and seventh abdominal tergites with two rows of bristles..... 2.

2. 7s of female more or less incurved twice, sinus shallow, lobes short, central lobe situated below middle of apex. Stylet more than three times as long as wide at base. Incrassation not well defined. Stigma of 8t smaller..... *C. parvus* Jordan.

7s of female distinctly incurved twice, sinus deeper, lobes longer, central lobe situated at middle of apex. Stylet less than three times as long as wide at base. Incrassation well defined, upper portion nearly parallel with upper sinus. Stigma of 8t larger.... *C. dinormus* Jordan.

40. CTENOPHTHALMUS PARCUS Jordan, 1932. Text figs. 71 and 72.

Front strongly rounded, tubercle a little below middle. Labial palpus reaching to four-fifths of fore coxa. Pronotal comb of eighteen to twenty spines which are at least as long as pronotum, usually longer. Hind tibia with seven dorsal notches. Stigma of 8t small.

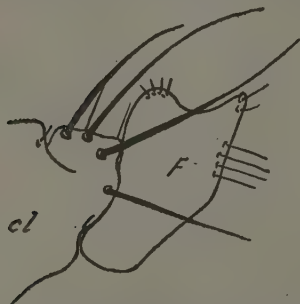


FIG. 71. *Ctenophthalmus parvus*, male. (After Jordan.)

Male.—Process of clasper short and broad, with four or five long bristles, apex more or less truncate, slightly wavy. Manubrium short and hooked at apex. Finger broadest at apex which is deeply sinuate and divided into a rounded anterior lobe with four spiniform



FIG. 72. *Ctenophthalmus parvus*, female, variations of seventh sternite. (After Jordan.)

bristles and a conical posterior lobe. Apex of posterior arm of 9s about two and one-half times as long as broad, gradually rounded from upper angle ventrad, with about fifteen thin bristles.

Female.—Apex of 7s with an upper sinus and a lower sinus, both shallow, lobes short, upper lobe broader than lower; marginal area incrassate. Stylet elongate-conical, slender, a little more than thrice as long as broad.

41. CTENOPHTHALMUS YUNNANUS Jordan, 1932. Text fig. 73.

Closely allied to *C. parvus*. Process of clasper differing in having a sinus which divides it into a rounded anterior lobe and a conical posterior lobe. Finger slender, apex slightly incurved. Apex of anterior arm subtruncate, that of posterior arm more truncate.

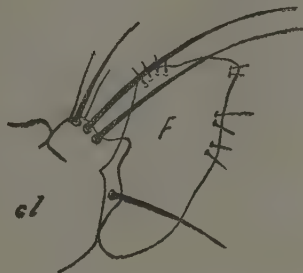


FIG. 73. *Ctenophthalmus yunnanus*, male. (After Jordan.)

42. CTENOPHTHALMUS DINORMUS Jordan, 1932. Text fig. 74.

Female.—Near *C. parvus*. Apex of 7s incurved twice as in *C. parvus*, sinus deeper, lobes therefore longer; internal incrassation with a well-defined frontal margin, which above middle lobe is parallel with the apical margin of 7s and below upper lobe forms a narrow, gently curved, posteriorly pointed ridge. Stigma of 8t larger. Stylet much shorter.

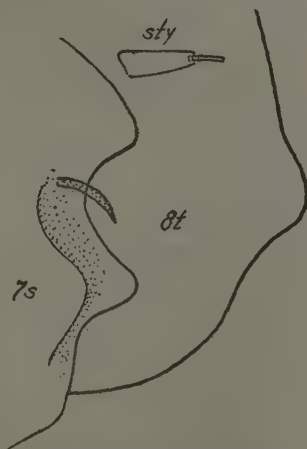


FIG. 74. *Ctenophthalmus dinormus*, female. (After Jordan.)

Subfamily RHADINOPSYLLINÆ Wagner, 1930

Head with genal comb, which is obliquely vertical, composed of four to six spines. Eye rudimentary. Antennal groove closed, at least in female. Antepygidial bristles present in female, lacking in male.

Key to the genera of Rhadinopsyllinæ.

1. Ocular bristle present. Dorsal margins of abdominal tergites and ventral margins of abdominal sternites not sclerotized. *7t* of female with two, seldom three, antepygidial bristles, and without a process.

Rectofrontia Wagner et Argyropulo.

- Ocular bristle absent. Dorsal margins of abdominal tergites and ventral margins of abdominal sternites strongly sclerotized. *7t* of female with a process bearing two spines between two groups of three antepygidial bristles *Stenischia* Jordan.

14. Genus STENISCHIA Jordan, 1932

Female.—All spines of genal comb on genal margin, none at margin of antennal groove. Ocular bristle lacking. Eye vestigial. Metepisternum fused with metanotum. Both meso- and metasterna with ventral projection. Dorsal and ventral margins of abdomen strongly sclerotized from base to row of long bristles. *7t* between two groups of three antepygidial bristles with a process bearing two spines. Coxæ and femora reduced in width.

43. STENISCHIA MIRABILIS Jordan, 1932. Text fig. 75.

Female.—Frontal tubercle prominent. A genal comb of five unequal spines, all of which are situated on genal margin and none at margin of antennal groove. Eye present as a short

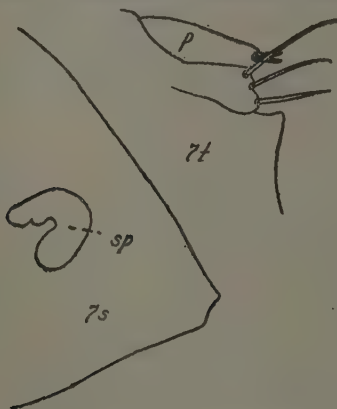


FIG. 75. *Stenischia mirabilis*, female.
(After Jordan.)

sulcus below margin of antennal groove. Pronotum with a comb of sixteen spines and a row of ten bristles. Mesonotum incrassate at anterior and dorsal margins. Apical spines on metanotum absent. Fore coxa nearly thrice and mid- and hind coxæ more than twice as long as wide at broadest point. Femora reduced in width. Longest apical bristle of fifth hind tarsal segment reaching to basal third of fourth. All fifth tarsi with four pairs of plantar bristles. *7s* trian-

gular, posterior margin slanting to near ventral angle, which is obliquely truncate-emarginate. *7t* with a sharp angle below

44. *RECTOFRONTIA DAHURICA* (Jordan et Rothschild, 1923). Text fig. 76.

Frontal tubercle present. Genal comb composed of five spines, ventral spine nearly one-fourth shorter than dorsal, dorsal spine one-fifth shorter than subdorsal, which is longest. Pronotal comb composed of nineteen to twenty-one spines. Second hind tarsal segment with one long apical bristle reaching beyond fourth.

Male.—8t without bristles below stigma; 8s with a ventro-apical row of seven to nine long bristles. Process of clasper conical. Manubrium strongly curved, proximally broad and abruptly slender at apex. Finger slender, tapering towards apex, reaching apex of clasper or a little beyond, anterior margin smooth. Posterior arm of 9s sole-shaped, widest above middle, much wider than anterior arm.

Female.—Tail of spermatheca not carved in.

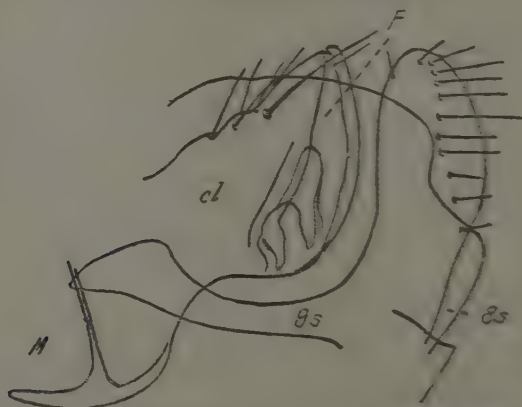


FIG. 76. *Rectofrontia dahurica*, male. (After Jordan and Rothschild.)

45. *RECTOFRONTIA TENELLA* (Jordan, 1929). Text figs. 77 and 78.

Frontal tubercle prominent. Genal comb with five spines, upper spine much broader and much more dorsal than ventral spine. Labial palpus 5-jointed. Pronotal comb composed of sixteen or seventeen spines. Longest apical bristle of second hind tarsal segment extending beyond apex of fourth.

Male.—8s with a row of three bristles on each side. Manubrium not strongly widened towards base. Clasper dorso-apically rounded and incurved, not conical, strongly ventricose on ventral margin. Finger strongly curved in basal half, widest near base and tapering gradually towards apex. Posterior arm

of 9s of similar width with finger, much narrower than anterior arm and tapering towards apex.

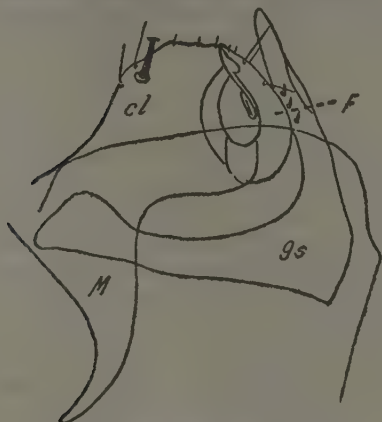


FIG. 77. *Rectofrontia tenella*, male.
(After Jordan.)

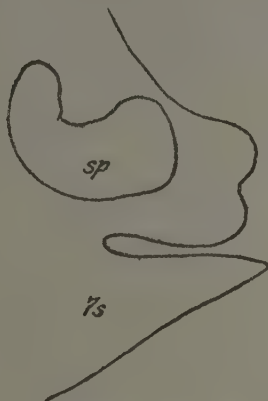


FIG. 78. *Rectofrontia tenella*, female.
(After Jordan.)

Female.—Apex of 7s without sinus, very broad and rounded. Tail of spermatheca caved in on posterior side, bearing a projection below cavity. A small species, less than two millimeters long.

46. *RECTOFRONTIA DIVES* (Jordan, 1929). Text figs. 79 and 80.



FIG. 79. *Rectofrontia dives*, male. (After Jordan.)

Genal comb composed of seven or eight spines, dorsal spine shorter than rest. Frontal tubercle central in position. Labial palpus 5-jointed. Pronotal comb composed of twenty-six to twenty-eight spines. Fifth segment of all tarsi with five pairs of plantar bristles.

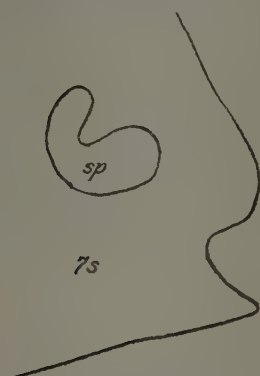


FIG. 80. *Rectofrontia dives*, female.
(After Jordan.)

or nine spiniform bristles at and close to apical margin. Spermatheca with subcylindrical tail.

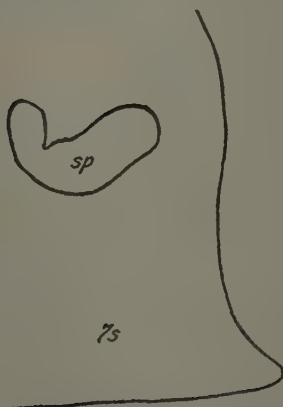


FIG. 81. *Rectofrontia jaonis*, female.
(After Jordan.)

Male.—8t with some bristles above stigma. Clasper with one long dorsal bristle and many small bristles, lower margin strongly ventricose. Finger very slender, widest at middle and reaching apex of process of clasper, anterior margin smooth. Proximal dilation of anterior arm of 9s angulate on anterior and posterior sides, posterior arm widest at apex, anterior arm narrower than posterior arm.

Female.—Apex of 7s divided by a broad, rounded subventral sinus into a broad, round upper lobe and a conical lower lobe. 8t with eight

47. *RECTOFRONTIA JAONIS* (Jordan, 1929).
Text fig. 81.

Female.—Frontal tubercle small, nearer to oral angle. Labial palpus secondarily divided into seven or eight segments, divisions not quite complete. Genal comb composed of four spines, upper spine shortest. Longest apical bristle of first hind tarsal segment reaching beyond third segment. Apical margin of 7s strongly slanting, slightly and broadly incurved so as to form a rounded ventral lobe.

48. RECTOFRONTIA INSOLITA (Jordan, 1929). Text figs. 82 and 83.

Frontal tubercle prominent. Genal comb composed of seven spines, rarely six. Labial palpus 6-jointed, reaching beyond apex of fore coxa. Pronotal comb composed of about twenty-

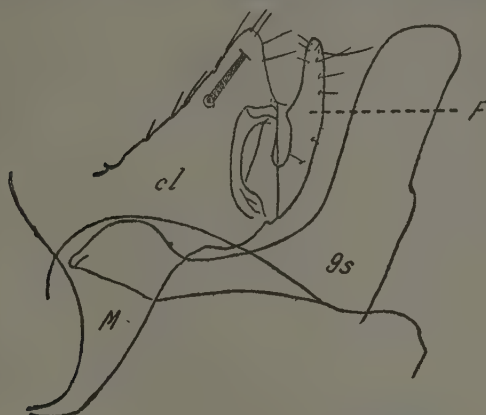


FIG. 82. *Rectofrontia insolita*, male. (After Jordan.)

five spines. Longest apical bristle of second hind tarsal segment reaching beyond fourth.

Male.—Clasper with a long subdorsal bristle. Manubrium strongly broadened towards clasper. Finger with a sharp process at middle of anterior margin. Posterior margin of proximal dilation of anterior arm of 9s rounded, not distinctly angulate; posterior arm wider than anterior arm, of nearly even width and with two subdorsal rows of spiniforms.

Female.—Upper apical margin of 7s strongly slanting dorsally; lower portion with a deep narrow bay, lobe above bay sinuate near middle, thus divided into two round sublobes, lobe below bay conical. 8t with one bristle above stigma, a row of four to five bristles below stigma.

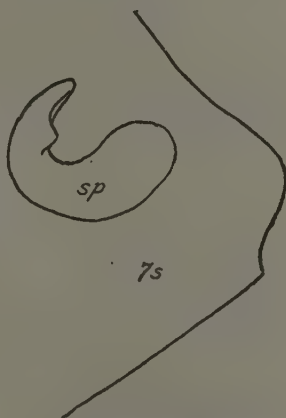
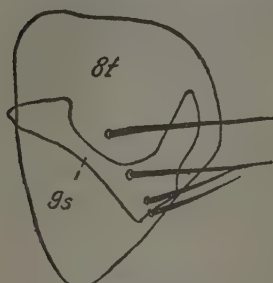


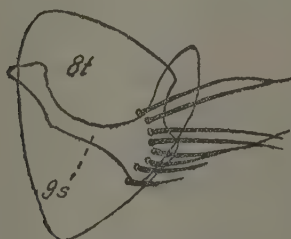
FIG. 83. *Rectofrontia insolita*, female. (After Jordan.)

49. RECTOFRONTIA ACCOLA (Wagner, 1929). Text fig. 84.

FIG. 84. *Rectofrontia accola*, male.
(After Wagner.)

Male.—Dorsal spine of genal comb longer than ventral spine, with end reaching to three-fourths length of subdorsal spine. Ocular bristle not accompanied by any other bristles. Middle abdominal sternites with two bristles on each side. 8s with apical margin rounded off, without a side projection and with a row of one to four long bristles. Manubrium very short, wide at base. Posterior arm of 9s with an incurving along posterior margin, thumblike in outline.

50. RECTOFRONTIA VICINA (Wagner, 1929). Text fig. 85.

FIG. 85. *Rectofrontia vicina*, male.
(After Wagner.)

Male.—Dorsal spine of genal comb somewhat longer than ventral spine, attaining two-thirds length of subdorsal spine. Middle abdominal sternites with three bristles on each side. 7s with eight stout bristles in an arched row near apex. Posterior arm of 9s much broader than anterior arm which is angulate at middle.

2. Family CTENOPSYLLIDÆ Baker, 1905

Head usually with genal comb. Eyes present or absent. Vertical suture between bases of antennal grooves distinctly present. Thoracic segments not strongly shortened, their tergites together longer than first abdominal segment. Pronotal comb often present. Abdomen often with combs and heavily clothed with bristles. Antepygial bristles, as a rule, present. Male, clasper with one movable finger. Female, abdomen of gravid female only slightly distended, provided in a number of genera with two seminal receptacles.

Some members of this family are very large.

Key to the subfamilies of Ctenopsyllidæ.

1. Genal comb composed usually of three or more spines, none of them overlapping CTENOPSYLLINÆ.
- Genal comb composed of two spines, one of which overlaps the other. NEOPSYLLINÆ.

Subfamily CTENOPSYLLINÆ Wagner, 1927

Genal comb consisting of three or more spines, none of them overlapping. Abdomen of female with one seminal receptacle.

Key to the genera of *Ctenopsyllinæ*.

1. Labial palpus consisting of one or two segments, not extending much beyond apex of maxilla..... *Stenoponia* Jordan et Rothschild.
Labial palpus consisting of five segments, extending much beyond apex of maxilla 2.
2. Frontal spiniform absent. Genal comb composed of three or more flattened leaflike spines..... *Palæopsylla* Wagner.
Frontal spiniform present. Genal comb composed of ordinary spines.... 3.
3. Position of eye normal. Genal comb composed of four or less spines.
Ctenopsyllus Kolenati.
Position of eye near top of front. Genal comb composed of fifteen spines.
Pectinoctenus Wagner.

16. Genus STENOPONIA Jordan et Rothschild, 1911

Labial palpus 1- or 2-segmented, not extending much beyond apex of maxilla. Genal process narrow and short, not reaching further backwards than uppermost spine of genal comb. Club of antenna short in both sexes. First pair of plantar bristles of fifth tarsal segment placed in between second pair. Female with only one spermatheca.

51. STENOPONIA CÆLESTIS Jordan et Rothschild, 1911. Text figs. 86 and 87.

Female.—Genal comb composed of nine spines. Labial palpus 1-segmented. Pronotal comb composed of thirty-five spines. Ab-



FIG. 86. *Stenoponia caelestis*, female, head. (After Jordan and Rothschild.)

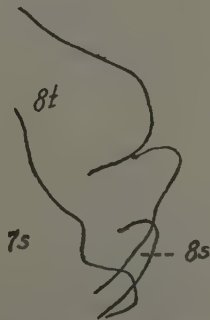


FIG. 87. *Stenoponia caelestis*, female (After Jordan and Rothschild.)

dominal tergites with only two rows of bristles each, only first, second, and third segments having an incomplete third row. Comb of 1*t* consisting of thirty-one spines on two sides together. Four antepygidial bristles on each side. Apex of 7*s* divided by a rather deep sinus.

8*t* divided by an apical incision into a broad, setose upper lobe and a narrow, naked lower lobe. A large species, 3.5 millimeters long.

17. Genus PALÆOPSYLLA Wagner, 1902

Frontal tubercle prominent. One frontal row. Eye vestigial. Vertical genal comb composed of four flattened spines, dorsal spine short and triangular, second from above long, much pointed. Labial palpus 5-segmented. Two occipital rows present. Inner side of hind coxa without spinelets. Fifth tarsal segment with first pair of plantar bristles situated between second pair. Some abdominal segments with short apical teeth. Three antepygidial bristles.

Male.—8*s* very broad. Process of clasper not marked.

52. PALÆOPSYLLA REMOTA Jordan, 1929. Text fig. 88.

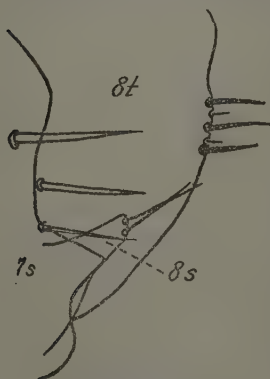


FIG. 88. *Palaeopsylla remota*, female.
(After Jordan.)

Female.—Dark portion of short upper genal spine narrower, second spine broader than in other species of this genus, third spine pointed. Labial palpus reaching to apex of fore coxa. Pronotal comb composed of fifteen long, narrow spines. Apex of 7*s* with a broad upper lobe and a triangular subventral lobe, latter projecting more than former. 8*t* with a vertical row of three bristles on ventral middle portion; apical margin shallowly sinuate, with three bristles below sinus exclusive of two small ones between them. Apex of 8*s* conical, with long apical bristles.

18. Genus CTENOPSYLLUS Kolenati, 1863

Head strongly angulated. Front with two or more spiniforms near frontal tubercle. Vertical genal comb composed of two to four, seldom six, spines. Eye feebly developed, almost un-

pigmented. Ocular row composed of two bristles. Three occipital rows. Hind tibia with a row of numerous short, equal bristles forming a comb. Fifth tarsal segment with first pair of plantar bristles situated between second pair. Antepygidial bristles, three in male and four or five in female. 8s well developed in male.

53. *Ctenopsyllus segnis* (Schönherr, 1811). Text figs. 89 and 90.

Four genal spines forming a vertical row. Many frontal bristles of which two are spiniform. Three well-developed occipital rows. Pronotal comb composed of about twenty spines.

Male.—Process of clasper with apex rounded. Finger more than twice as long as broad, almost of even width from base to apex, slightly and nearly evenly curved along posterior margin.



FIG. 89. *Ctenopsyllus segnis*, female, head. (After Rothschild.)

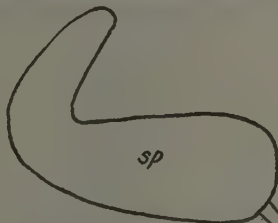


FIG. 90. *Ctenopsyllus segnis*, female, spermatheca. (After Fox.)

Female.—Stylet less than three times as long as basally broad. Head of spermatheca elongate, about one-third longer than tail and about twice as broad at base as at tail.

19. Genus *PECTINOCTENUS* Wagner, 1929

Differs from *Ctenopsyllus* by the complete development of an antennal comb which runs parallel to the entire anterior margin of the antennal groove, and by the dislocation of the eye towards the top of the head near the base of antennæ, in fact limited by the development of the genal comb.

54. *PECTINOCTENUS ADALIS* Jordan, 1929. Text fig. 91.

Male.—Genal comb composed of fifteen spines. Pronotal comb composed of thirty-two spines. Besides apical row, three rows of bristles on mesonotum and two on metanotum. Metepimeron with eight (four, three, one) bristles. Abdominal



FIG. 91. *Pectinoctenus adalis*, male. (After Jordan.)

tergites with two rows of bristles each. Three antepygidial bristles. 8t with eight bristles on widened area below stigma. Process of clasper slender, gradually narrowing. Finger widest above middle, posterior margin rounded from this point to tip, provided with eight bristles, no spiniform present. Apex of process of clasper and finger clawlike, brown, curved toward each other. 9s with broad anterior arm and very narrow posterior arm; anterior arm with a narrow, rounded proximal apex, distal half of posterior arm bristly.

Subfamily NEOPSYLLINÆ Oudemans, 1909

Genal comb reduced to two spines, one of which overlaps the other.

20. Genus NEOPSYLLA Wagner, 1902

Frontal tubercle small. Genal comb consisting of two overlapping spines. Front reduced. Hind coxa with or without a patch of spinelets. First pair of plantar bristles of hind legs moved on to ventral surface between second pair, or first pair of plantar bristles of all legs placed ventrally between second pair. Some abdominal segments with dorsal apical teeth.

Key to the species of *Neopsylla*.

1. Male, process of clasper not divided into two lobes. Female, upper angle of apex of 7s not divided into two lobes..... 2.
Male, process of clasper divided into two lobes. Female, upper angle of apex of 7s divided into two lobes..... 5.
2. Pronotum with two rows of bristles in front of pronotal comb. Male, finger with very acuminate apex..... 3.
Pronotum with one row of bristles in front of pronotal comb. Male, finger without very acuminate apex..... 4.
3. Male, finger with an acuminate apex. Female, apex of 7s with an upper long, rounded lobe..... *N. bidentatiformis* (Wagner).
Male, unknown. Female, apex of 7s without this lobe, shallowly sinuate near middle..... *N. compar* Jordan et Rothschild.
4. Occiput with two rows of bristles. Male, finger widest near distal part, evenly rounded along posterior margin. Female, 7s with rounded lobe above sinus..... *N. aliena* Jordan et Rothschild.
Occiput with three rows of bristles. Male, finger widest near proximal portion, slightly concave near middle of posterior margin. Female, 7s with triangular or pointed lobe above sinus.... *N. anoma* Rothschild.

5. Male, second lobe of process of clasper very broad and more or less rounded. Posterior margin of finger evenly convex and without spiniform..... 6.
- Male, second lobe of process of clasper narrow and distinctly conical. Posterior margin of finger slightly concave near middle and with a spiniform near base..... *N. honora* Jordan.
6. Male, second lobe of process of clasper bearing bristles along anterior half of dorsal margin. Finger robust, about two and one-half to three times as long as wide. Manubrium broad and widest at middle. 8s not triangular and with broad apex..... *N. specialis* Jordan.
- Male, second lobe of process of clasper bearing bristles along posterior half of dorsal margin. Finger slender and about five times as long as wide (near middle). Manubrium slender, widest at base. 8s triangular with sharp apex. Female, upper angle of 7s divided into two pointed lobes..... *N. stevensi* Rothschild.

55. *NEOPSYLLA BIDENTATIFORMIS* (Wagner, 1893). Text figs. 92 to 94.

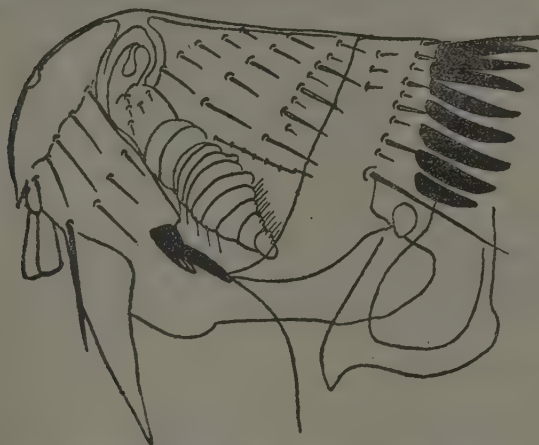


FIG. 92. *Neopsylla bidentatiformis*, male, head. (Author's drawing.)

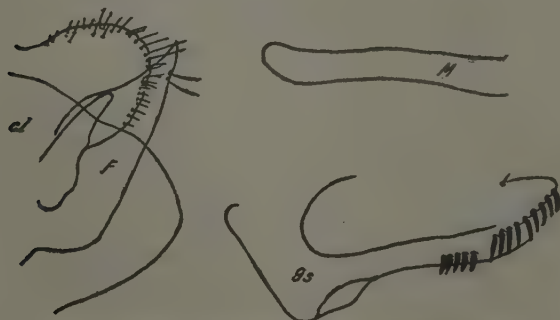


FIG. 93. *Neopsylla bidentatiformis*, male. (Author's drawing.)



FIG. 94. *Neopsylla bidentatiformis*, female.
(Author's drawing.)

Front perpendicular, with a small frontal tubercle. Eye incompletely pigmented in male. Antennal groove produced partly onto prosternum. Ocular row composed of four bristles and frontal row of five short bristles. Occiput with three rows of bristles. Pronotal comb composed of eighteen spines. Metepimeron with three rows of transverse vertical bristles of which the two front rows are curved.

Male.—Process of clasper very much rounded and hairy. Finger with pointed apex, posterior margin more or less truncate. Posterior arm of 9s along apicoventral margin with a row of about fifteen shortened bristles.

Female.—Apex of 7s with two rows of stout bristles, slightly sinuate, lobe above sinus projecting, rounded. 8s heavily beset with straight bristles projecting backward; marginal row consisting of nine bristles, about fifteen lateral bristles of which at least four are long.

56. *NEOPSYLLUS ANOMA* Rothschild, 1912. Text figs. 95 and 96.

Front strongly rounded with a small frontal tubercle. Eyes almost absent. Frontal row composed of six to eight bristles, ocular row composed of four bristles. Occiput with three rows.

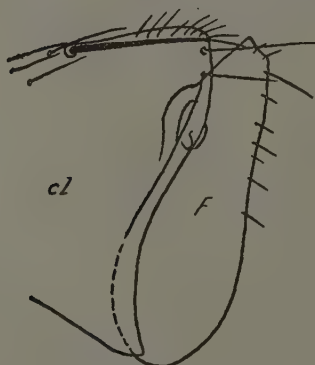


FIG. 95. *Neopsyllus anoma*, male. (After Rothschild.)



FIG. 96. *Neopsyllus anoma*, female. (After Rothschild.)

Pronotal comb composed of eighteen spines. Hind coxa bearing a patch of spinelets on inner side.

Male.—8t bearing six short hairs above stigma. 8s large, apically truncate-emarginate in lateral view, with angles strongly rounded off. Body of clasper large, upper angle rounded, lower angle acute. Manubrium widest at center. Finger as long as clasper, apex sharp, right-angled. Anterior arm of 9s broad, elbowed, proximally rounded, posterior arm narrowest at middle, bearing along ventral margin one long bristle and several smaller bristles.

Female.—Apex of 7s with a round sinus, lobe above sinus pointed, lobe below sinus broadly rounded. 8t with six short hairs above stigma; no short hairs below, and six or seven long bristles at lower portion; apex sharply pointed. Spermatheca with tail much longer than head.

57. *NEOPSYLLA ALIENA* Jordan et Rothschild, 1911. Text figs. 97 and 98.

Front vertical in male, more slanting in female. Eye indicated by a narrow oblique bar. Frontal row composed of five to



FIG. 97. *Neopsylla aliena*, male. (After Jordan and Rothschild.)

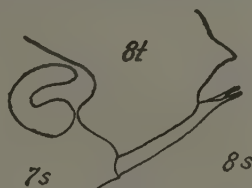


FIG. 98. *Neopsylla aliena*, female. (After Jordan and Rothschild.)

nine bristles, ocular row of three bristles. Pronotal comb composed of sixteen spines. Metepimeron with twelve to fourteen (four to six, five, two or three) bristles. Hind coxa with a patch of spinelets on inner surface. All five pairs of plantar bristles lateral in position.

Male.—8s broad, apex almost evenly rounded in side view. Body of clasper almost square, without acetabular bristles. Manubrium widest at center. Posterior margin of finger evenly rounded, bearing a number of small bristles. 9s with a somewhat cylindrical and broad anterior arm; posterior arm broad proximally, narrowing towards apex, bearing seven pairs of bristles.

Female.—7s divided by a central sinus into a rounded upper lobe and a broader, less rounded lower lobe. Upper apical angle of 8t pointed. 8s bearing no bristles and ending on each side in a long slender point. Tail of spermatheca about twice as long as head.

58. *NEOPSYLLA COMPAR* Jordan et Rothschild, 1911. Text fig. 99.

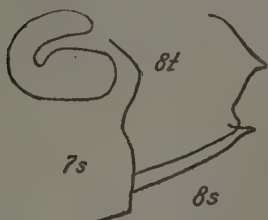


FIG. 99. *Neopsylla compar*, female. (After Jordan and Rothschild.)

Female.—Closely allied to *N. bidentatiformis*. Pronotum bearing a row of eight small bristles in front of postmedial row of bristles on two sides together. Hind coxa with a patch of spinelets. Dorsal bristles of hind tibia thinner. Apex of 7s shallowly sinuate. 8t bearing a marginal row of six or seven bristles, near these bristles about eight more, of which two are long.

59. *NEOPSYLLA STEVENSI* Rothschild, 1915. Text figs. 100 and 101.

Male.—Near *N. anoma*. 8s broadly conical at apex, bearing about fifteen stout bristles. First process (P_1) of clasper long,

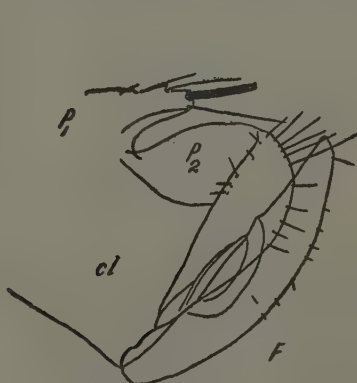


FIG. 100. *Neopsylla stevensi*, male. (After Rothschild.)

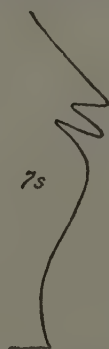


FIG. 101. *Neopsylla stevensi*, female. (After Rothschild.)

with two or three long bristles at apex and some short bristles at dorsal margin, no bristle at ventral margin; second process very broad, distinctly rounded. Manubrium slender, gradually tapering towards apex. Finger very long, evenly rounded at posterior margin. Apical portion of posterior arm of 9s bearing about twenty-two shortened bristles.

Female.—Apex of 7s very peculiar, upper angle divided into two small pointed lobes.

60. *NEOPSYLLA SPECIALIS* Jordan, 1932. Text fig. 102.

Male.—Near *N. stevensi*, but differing in genitalia. 8s rounded at apex, bearing dozen bristles of which two subapical ones are longest. First process of clasper slightly shorter; second process divided apically into an anterior bristled lobe and a pale rounded lobe. Manubrium very broad, widest at middle. Finger somewhat spindle-shaped, about two and one-half times as long as broad, posterior margin evenly rounded from base to apex. Acetabulum extending much farther dorsad than in *N. stevensi*. Anterior arm of 9s broad, somewhat cylindrical; posterior arm narrowing at apical third, apex with a ventral row of six shortened bristles.

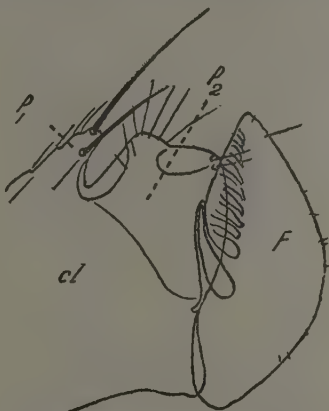


FIG. 102. *Neopsylla specialis*, male. (After Jordan.)

61. *NEOPSYLLA HONORA* Jordan, 1932. Text fig. 103.

Male.—Near *N. stevensi*. 8s with four long subapical bristles. First process of clasper much shorter than those of *N. stevensi* and *N. specialis*; second process conical, with four bristles at apex. Manubrium of clasper narrowing very gradually from base to apex, which is turned up at tip. Finger rectangular, with posterior margin incurved at middle, and a spiniform at posteroventral angle. Anterior arm of 9s unusually broad and short; posterior arm narrowing to a point, bearing only thin bristles.



FIG. 103. *Neopsylla honora*, male. (After Jordan.)

3. Family ISCHNOPSYLLIDÆ Wahlgren, 1907

Head without genal comb, but with two preoral flaps at anteroventral portion on each side. Eyes usually greatly reduced or absent. Vertical suture between bases of antennal grooves distinctly present. Thoracic segments not strongly shortened, their tergites together longer than first abdominal tergite. Pronotal comb often present. Abdomen with or without true combs made up of subequal toothlike spines, or false combs made up of enlarged setæ of a transverse row; abdomen with two rows of setæ to each typical tergite, and with tiny apical teeth on some tergites. Antepygidial bristles present or absent. Clasper of male with one movable finger. Abdomen of gravid female only slightly distended, provided with only one seminal receptacle. The members of this family are confined entirely to bats.

Key to the genera of Ischnopsyllids.

1. Maxilla sharp and pointed. Antepygidial bristles absent, instead of which there is a false comb on 7t..... *Nycteridopsylla* Oudemans.
- Maxilla truncate. Antepygidial bristles present..... 2.
2. Abdomen with false combs formed by thickening of some bristles in one of transverse rows. Abdominal segments with a transverse dorsal incrassation *Myodopsylla* Jordan et Rothschild.
- Abdomen with true combs of subequal toothlike spines.

Ischnopsyllus Westwood.

21. Genus ISCHNOPSYLLUS Westwood, 1833

Maxilla truncate at apex. Ocular bristle near anterior margin of antennal groove. Two or three rudimentary occipital rows. Six to eight true combs of subequal toothlike spines on thorax and abdomen. Antepygidial bristles present. Male, two acetabular bristles. Female, ductus seminalis with dilated portion.

Key to the species of Ischnopsyllus.

1. Mesonotum with a group of six very long dorsoapical bristles. Male, 8s arm-and-fist-shaped, without bladelike bristles. Finger widest at base and apex. Female, apex of 7s slanting. Tail of spermatheca much longer than head..... *I. comans* Jordan et Rothschild.
- Mesonotum without a group of long dorsoapical bristles. Male, 8s of different shape, with bladelike bristles. Finger widest either at apex or at base. Female, apex of 7s rounded-dilated at middle. Tail of spermatheca shorter than head..... 2.
2. Male, apex of 8s club-shaped, with one bladelike bristle. Process of clasper short and rounded. Female, stylet conical. Head of spermatheca subglobose, about two and one-half times as broad as tail.

I. tateishii Sugimoto.

Male, apex of 8s not club-shaped, and with five long, bladelike bristles.

Upper process of clasper long, conical. Female, stylet more or less cylindrical. Head globose, about two times as broad as tail.

I. needhamia Hsü.

62. *ISCHNOPSYLLUS COMANS* Jordan et Rothschild, 1921. Text figs. 104 to 106.

Mesonotum with a group of six very long dorsoapical bristles.

Male.—8t irregularly square, upper posterior margin slightly incurved, with ten bristles. 8s narrowest in middle, slightly



FIG. 104. *Ischnopsyllus comans*, male, head. (After Jordan and Rothschild.)



FIG. 105. *Ischnopsyllus comans*, male. (After Jordan and Rothschild.)

widening distally, with apex curved upwards and bearing three long apical bristles. Clasper also irregularly square, distal margin moderately incurved, both upper and lower angles rounded, upper angle produced as a broad rounded lobe, lower angle bearing two very large spiniform bristles. Finger about twice as long as broad, with both anterior and posterior margins incurved and bearing two spiniforms situated farther apart along posterior margin, and, in addition, four apical bristles. 9s divided by a deep ventral sinus into two lobes; proximal lobe broad, ventrally rounded-dilated, tapering towards apex; apical lobe narrow, widest at middle, bearing five thin bristles.



FIG. 106. *Ischnopsyllus comans*, female. (After Jordan and Rothschild.)

Female.—7s slanting upwards. Stylet short, conical, about two and one-half times as long as broad. Spermatheca with a subglobose head and a long tail.

63. ISCHNOPSYLLUS NEEDHAMIA Hsü, 1935. Text figs. 107 and 108.

Dorsoapical bristles of mesonotum short.

Male.—8t irregularly square, posterior margin slightly incurved, bearing seventeen bristles behind stigma. 8s bearing at apicoventral margin a row of six bristles, proximal to them a group of five very stout, bladelike bristles of which two hind ones are situated on the outer surface, and the three anterior

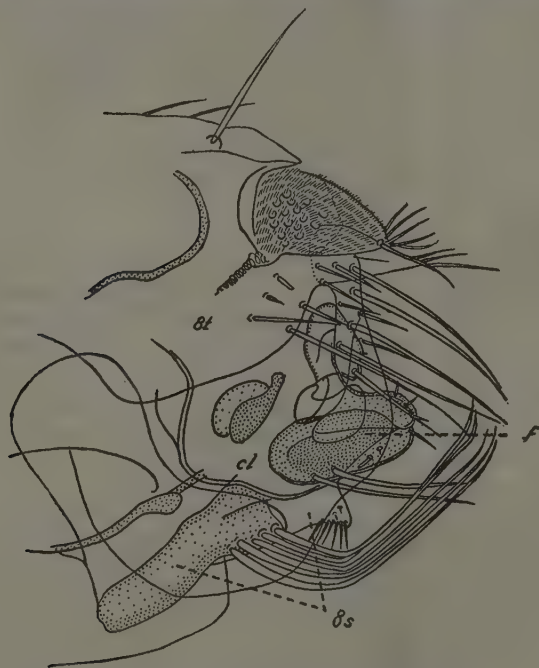


FIG. 107. *Ischnopsyllus needhamia*, male. (Author's drawing.)

ones on the inner surface. Clasper with a long, projecting upper angle, bearing two weaker spiniform bristles at lower angle. Finger oval, pointing posteriorly, and bearing four short apical bristles and one spiniform at middle of ventral margin.

Female.—Apex of 7s less rounded-dilated than in *I. tateishii*. Stylet short, cylindrical, about twice as long as broad. Spermatheca with globose head which is not longer than tail.

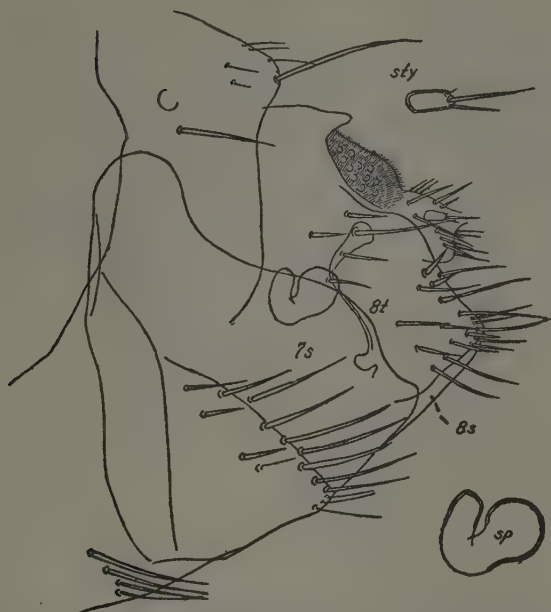


FIG. 108. *Ischnopsyllus needhamia*, female. (Author's drawing.)

64. *ISCHNOPSYLLA TATEISHII* Sugimoto, 1933. Text figs. 109 and 110.

Dorsoapical bristles of mesonotum short.

Male.—8t irregularly square, posterior margin not incurved, bearing ten bristles. 8s with club-shaped apex which bears an apical bladelike bristle. Clasper square, distal margin truncate, not incurved, both angles rounded, lower angle bearing two very large spiniform bristles. Finger slender, about four times as long as broad at middle, bearing only one spiniform at middle of posterior margin and, in addition, four short apical bristles. 9s also divided into two lobes; proximal lobe ventrally angulate; apical lobe widest at base, bearing two thin bristles.

Female.—Apex of 7s rounded-dilated at middle. Stylet slender, conical, about three and one-half to four times as long as broad. Spermatheca with a large subglobose head which is longer than tail.

22. Genus MYODOPSYLLA Jordan et Rothschild, 1911

Maxilla truncate. Eyes distinct. First segment of maxillary palpus longer than second. Pronotum with a true comb, all other combs composed of thickened bristles of submedian row of tergites. 7t on each side with a long apical bristle which stands on a conical process of margin. Of all tarsi first pair of plantar bristles of fifth tarsal segment standing between bristles of second pair, third pair displaced ventrally.

65. MYODOPSYLLA TRISELLIS Jordan, 1929. Text figs. 111 and 112.

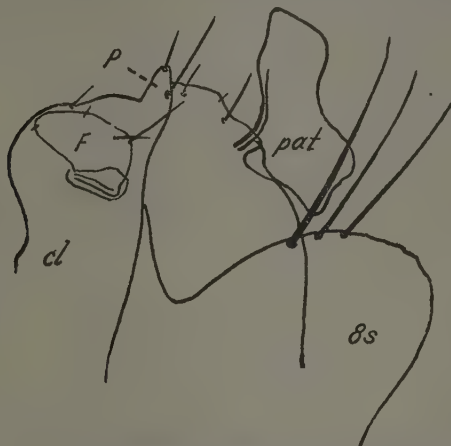


FIG. 111. *Myodopsylla trisellus*, male. (After Jordan.)

Meso-, and metanota with three rows of bristles. First and second abdominal tergites with three rows, others with two. First to third abdominal tergites with a false comb.

Male.—8s with a rounded apical lobe bearing numerous small bristles and three or four stout bristles at dorso-apical margin. Process of clasper conical, bearing two longish bristles. Manubrium very large, longer and basally broader than body of clasper.

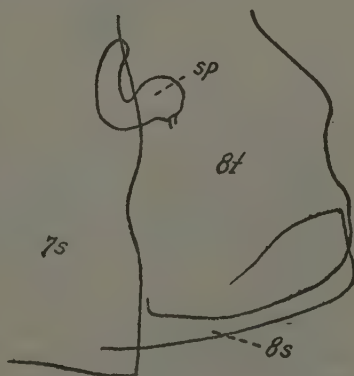


FIG. 112. *Myodopsylla trisellus*, female. (After Jordan.)

Finger short, slightly elbowed, less than twice as long as broad, resembling head of a bird. Paramere somewhat sole-shaped, posterior margin widely sinuate.

Female.—Apex of 7s strongly slanting, slightly incurved near middle. Spermatheca with a very long tail.

23. Genus NYCTERIDOPSYLLA Oudemans, 1906

Maxilla acuminate at apex. Ocular bristle absent. Occipital portion prolonged. Two or three rudimentary occipital rows. All species with five combs on thorax and abdomen excluding false comb on 7t. Antepygidial bristle absent. Male, one acetabular bristle. Female, ductus seminalis without dilated portion.

66. NYCTERIDOPSYLLA GALBA Dampf, 1910. Text figs. 113 and 114.

Male, front strongly arched. Genal process long, rounded off at apex. Eyes depigmented. Second antennal segment with a long bristle; three long bristles above posterior margin of

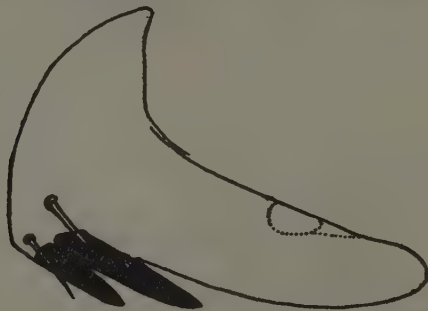


FIG. 113. *Nycteridopsylla galba*, male, part of head. (After Dampf.)

antennal groove. Occiput prolonged. All legs with five pairs of plantar bristles, first pair located between second pair. Altogether five true combs one each on pronotum (twenty-eight to thirty-five spines), metanotum (seven to fourteen spines), 1t (eighteen to twenty-four spines), 2t (eighteen to twenty-four spines), and 3t (sixteen to twenty-four spines). 7t with a false comb of ten spines on two sides together. Clasper triangular, with conical process and manubrium. Finger with a rounded lobe at anterodorsal margin, apex provided with two heavy blunt spiniforms, ventral margin with three spiniforms.

Apex of 9s widened in form of a knife, terminating in two sharp points.



FIG. 114. *Nycteridopsylla galba*, male. (Author's drawing.)

4. Family VERMIPSYLLIDÆ Wagner, 1889

Head without genal comb. Eyes present. Vertical suture between bases of antennal grooves absent. Preoral flaps lacking. Thoracic segments not strongly shortened, their tergites together longer than first abdominal segment. Pronotal comb lacking. Abdomen without combs, without tiny apical teeth on tergites, but with more than a single row of bristles to each typical abdominal tergite. Antepygidial bristles wanting. Clasper of male with one movable finger. Abdomen of gravid female more or less distended and provided with only one seminal receptacle.

This small family comprises three genera, of which only two are represented in China.

Key to the genera of Vermipsyllidæ.

1. Labial palpus with five, seldom six, segments..... *Chætopsylla* Kohaut.
 Labial palpus with ten or more segments..... *Vermipsylla* Schimkewitsch.

24. Genus **CHÆTOPSYLLA** Kohaut, 1903

Combs wanting. Frontal tubercle prominent. Ocular row composed of four bristles, ocular bristle before eye. Labial palpus composed of five, seldom six, segments. Gena often dark, blending with eye. Club of antenna long. One or two occipital rows. Fifth tarsal segment of all legs with four pairs of lateral plantar bristles. Antepygidial bristles wanting in both sexes.

Male.—8s longitudinally divided into two parts. Clasper broad and deep, disclike, without nonmovable process.

Female.—8t longitudinally divided into two parts. Abdomen of gravid female extensible. Usually hairy species.

67. **CHÆTOPSYLLA** **HANGCHOWENSIS** sp. nov. Text figs. 115 to 117.

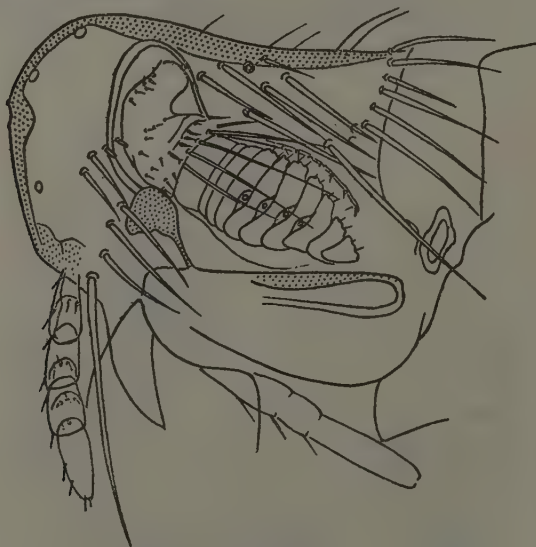


FIG. 115. *Chætopsylla hangchowensis* sp. nov., male, head.
 (Author's drawing.)

Allied to *C. homæus* Rothschild. Male differing from *homæus* by the finger distinctly tapering towards the apex, apex of manubrium bluntly rounded, posterior margin of clasper provided with fourteen long curved bristles, and shape of paramere

distinctly different. Female differing in that the apex of seventh sternite is rounded-truncate with a slightly incurved central sinus. From *C. mikado* Rothschild, which was known only in the female form, the present species can be distinguished by the longer bristles of the second antennal segment, the presence of three vertical rows of bristles on the epimeron of metathorax, and the thin hairs of the frontal row.

Head.—Head evenly rounded from occiput to mouth in female and slightly concave above occiput in male. Frontal tubercle prominent, situated at middle of frontal margin. Ocular row



FIG. 116. *Chætopsylla hangchowensis* sp. nov., male.
(Author's drawing.)

composed of four stout bristles equidistant from each other. Obliquely above eye a frontal row of four (in male) or two to four (in female) small bristles, upper two bristles in male very small, lower two stout, in female all small; this row of small bristles above ocular row in male and somewhat in line with ocular row in female. Eyes distinct. Genal process acute. Bristles of second antennal joint reaching beyond middle of club in male and extending to or a little beyond apex of club in female. Eight (in male, three in female) short setæ present along posterior margin of antennal groove. Maxillary palpus shorter than

labial palpus; proportional lengths of segments of former 19:15:12:26 in female and 17:13:10:20 in male; in male maxillary palpus shorter than lowest bristle of ocular row, in female longer than lowest bristle of ocular row. Labial palpus reaching a little over four-fifths of length of fore coxa; seeming to consist of six or seven segments in male. Apex of maxilla acute. Occiput with a row of three bristles behind base of antenna, one small bristle preceding row and situated on hind

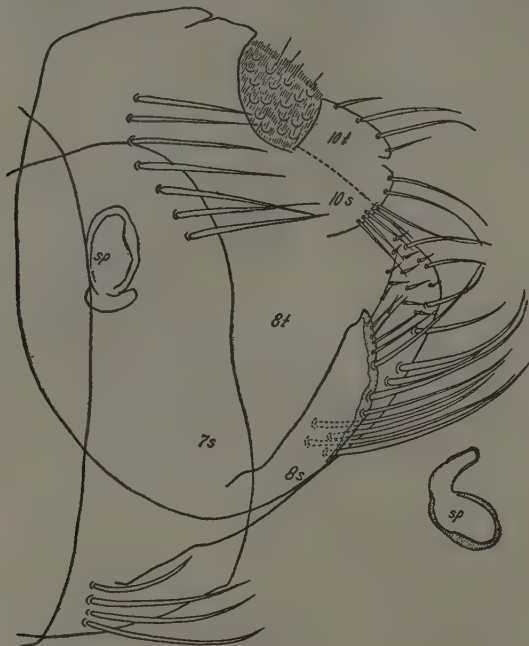


FIG. 117. *Chastopsylla hangchowensis* sp. nov., female.
(Author's drawing.)

margin of antennal groove, another row of three larger bristles behind middle of antenna, an apical row of eight (in male) or nine (in female) stout bristles on each side, of which lowest bristle is longest.

Thorax.—Pronotal comb lacking. Pronotum with an apical row of nine bristles on each side (excluding few small hairs between bristles), lowest bristle near spiracle longest. Mesonotum with a submedian row of five to seven bristles and an

apical row of five stout bristles. Mesepisternum with two (in male) or three (in female) bristles. Mesepimeron with four (in male) or five (in female) bristles, lowest bristle near spiracle widely apart and stoutest. Metanotum with a submedian row of six (in male) or eight (in female) strong bristles (excluding smaller ones) and an apical row of six (in male) or five (in female) stout bristles. Metepisternum with two rows of bristles (male, two, four; female, four, five). Metasternum with two rows of stout bristles (two, two). Metepimeron with three rows of bristles, bristles of first row slender, those of second very stout, those of third short and irregular, number of bristles in each row of male six, five or six, five; of female, eight or nine, five or six, seven.

Legs.—Outer surface of fore femur with about fourteen bristles. Hind femur with fourteen (in male) or seventeen (in female) bristles along ventral margin. Hind tibia with six pairs of dorsal spines and with a row of nine (in male) or eleven (in female) bristles on outer surface. Apical bristle of first hind tarsal segment as long as second tarsal segment, apical bristle of second and third hind tarsal segments exceeding apex of following segment. Proportions of tarsal segments of all legs:

		1st.	2d.	3d.	4th.	5th.
Male	Fore tarsi	18	18	17	13	34
	Midtarsi	27	22	18	13	30
	Hind tarsi	47	31	20	14	35
Female	Fore tarsi	20	25	20	16	40
	Midtarsi	40	36	23	17	35
	Hind tarsi	68	44	28	20	55

Abdomen.—Chætotaxy of abdominal segments on each side:

Male.—1*t*, three rows: two, six, five; 2*t*, two rows: six, nine (one below stigma); 3*t*, two rows: ten (five below stigma), seven (one below stigma); 4*t*, two rows: seven (three below stigma), six; 5*t*, two rows: two (one below stigma), seven (one below stigma); 6*t*, two rows; one (below stigma), five; 7*t*, one row of four.

Female.—1*t*, three rows: two, six, five; 2*t*, two rows: seven, five; 3*t*, two rows: ten (five below stigma), five; 4*t*, two rows: six (two below stigma), five; 5*t*, two rows: two, four; 6*t*, two rows: one, four; 7*t*, two rows: two, three.

Chaetotaxy on sternites:

Male.—3s, two rows: two, six (all hairs); 4s, two rows: two, five (all hairs); 5s, one row of five; 6s, one row of four; 7s, one row of four (stout bristles).

Female.—3s, two rows: three, five (all hairs); 4s, one row of three; 5s, one row of three; 6s, one row of two; 7s, one row of two. Antepygidial bristles lacking.

Modified segments.—*Male*.—8t with one row of eight bristles, lowest two stoutest. Clasper except part connected with manubrium cup-shaped, with a group of nine spinelets near dorsal margin or above finger, another group of sixteen spinelets below finger. Ventroposterior margin of clasper with fourteen stout bristles which are curved at apex, a character which distinguishes this species from all other species of the genus. Manubrium with distal part nearly of even width and with blunt apex. Finger cucumber-shaped, tapering towards apex. Shape of paramere characteristic of the species.

Female.—8t bearing on upper half five bristles above stigma and from stigma downwards a regular vertical series of twelve bristles, lower six bristles very stout; apex bearing fourteen bristles (six dorsal and eight ventral), three dorsal bristles and six ventral bristles very stout. On the inner side of apex of 8t about thirteen spinelets. 8s resembling in shape a broad bean pod, with a group of five (three or four paratypes) bristles near apex and below this group three (two or three in paratypes) stout bristles. Hind margin of 7s slightly concave at middle. Spermatheca somewhat distorted in allotype, figure in lower right-hand corner drawn from paratype.

Length, male, 1.4 millimeters, female, 2.5.

One male and four females taken off the Chinese weasel, *Putorius sinensis* from Hangchow, in 1935. Holotype, a male; allotype, a female, and three paratypes (females) in my collection.

25. Genus VERMIPSYLLA Schimkewitsch, 1885

No comb on head and pronotum. Frontal tubercle present. Eye present. Club of antennæ short, not much longer than broad. Labial palpus with ten or more segments. Ocular row composed of four or five bristles. Hind coxa without spinelets. Fifth segment of all tarsi with four pairs of lateral plantar bristles. Antepygidial bristles wanting. Gravid females with distended abdomen.

68. *VERMIPSYLLA DORCADIA* Rothschild, 1912.

Allied to *V. alakurt*. Tergites of thorax and abdomen bearing each two rows of bristles, anterior row dorsally more or less incomplete (almost absent in female), bristles of both rows short except two situated below stigma. Midtibia with four and hind tibia with only three pairs of long bristles at dorsal edge, including apical bristles, others reduced to slender bristles. First fore- and midtarsal segments shorter than second; hind tarsal second to fourth segments each with long apical bristles extending beyond fifth segment, thinner and shorter than those of *V. alakurt*. Abdominal sternites with only one bristle on each side.

5. Family PULICIDÆ Taschenberg, 1880

Head with or without genal comb. Eyes nearly always present. Vertical suture between bases of antennal grooves absent. Preoral flaps wanting. Thoracic segments not strongly shortened, their tergites together longer than first abdominal tergite. Pronotal comb absent or present. Abdomen without combs, with a single row of bristles to each typical tergite. Antepygidial bristles always present. Clasper of male with two movable fingers on each side. Abdomen of gravid female only slightly distended and provided, except in one genus, with only one seminal receptacle.

Subfamily PULICINÆ Tiraboschi, 1904

Club of antennæ asymmetrical, very slightly segmented on lower side, first segment of club lanceolate or spatulate. First midtarsal segment much shorter than second.

Key to the genera of Pulicinæ.

- | | |
|--|---|
| 1. Pronotal comb of spines and genal comb absent..... | 2. |
| Pronotal comb of spines and genal comb present..... | 3. |
| 2. Mesosternite rather narrow, without a vertical sclerotized rod besides an oblique one. Ocular bristle situated lower than eye.... | <i>Pulex</i> Linnæus. |
| Mesosternite very broad, with a vertical sclerotized rod besides an oblique rod. Ocular bristles situated before eye..... | <i>Xenopsylla</i> Glinkewicz. |
| 3. Genal comb composed of three or less spines. Pronotal comb much reduced, with eight or less spines..... | <i>Archæopsylla</i> Dampf. |
| Genal comb composed of more than three spines. Pronotal comb not reduced, with at least twelve spines.... | <i>Ctenocephalides</i> Stiles et Collins. |

26. Genus CTENOCEPHALIDES Stiles et Collins, 1930

Frontal tubercle absent. Eye present. Labial palpus 4-jointed. Club of antennæ distinctly segmented only on pos-

terior side. Ocular row of two bristles on gena. Genal comb of about seven to eleven rather long, pointed and recurved spines. A strong incrassation from antennal groove upwards. Two occipital rows of one bristle. Pronotal comb composed of sixteen to eighteen spines. Hind coxa with spinelets. One antepygial bristle on each side. 8s of male broad.

Key to the species of Ctenocephalides.

1. Front strongly rounded; distance from frontal corner across eye to anterior edge of antennal groove equal to distance from eighth genal spine to vertex. First spine of genal comb much shorter (about one-half) than second spine..... *C. canis* (Curtis).
 Front strongly pointed; distance from frontal corner across eye to anterior edge of antennal groove about one-fifth to one-third longer than distance from eighth genal spine to vertex. First spine of genal comb slightly shorter than second spine..... *C. felis* (Bouché).

69. CTENOCEPHALIDES CANIS (Curtis, 1826). Text figs. 118 and 119.

Front strongly rounded. Distance from frontal corner across eye to anterior margin of antennal groove equaling that



FIG. 118. *Ctenocephalides canis*, female, head. (After Rothschild.)



FIG. 119. *Ctenocephalides canis*, male. (After Rothschild.)

from eighth genal spine to vertex. First (anterior) spine of genal comb much shorter than second. Abdominal stigma larger.

Male.—Manubrium straight, narrow, distinctly widened at apex into a spatula. Finger sole-shaped, widening gradually towards rounded apex; finger bearing numerous setæ along edge, except basal third of dorsal margin and basal three-fourths of ventral margin.

Female.—8t less rounded at apex. Stylet less slender than in *C. felis*.

70. CTENOCEPHALIDES FELIS (Bouché, 1835). Text figs. 120 and 121.

Front less rounded. Distance from frontal corner across eye to anterior margin of antennal groove almost one-fifth (male) to one-third (female) longer than that from eighth genal spine

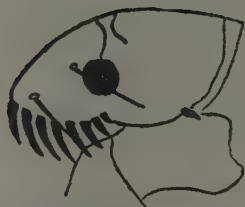


FIG. 120. *Ctenocephalides felis*, female, head. (After Rothschild.)



FIG. 121. *Ctenocephalides felis*, male. (After Rothschild.)

to vertex. Head much more pointed in outline. First spine of genal comb a little shorter than second. Abdominal stigma smaller.

Male.—Manubrium straight and narrow, only slightly widened at apex. Nonhairy portions of margins of finger shorter.

Female.—St more rounded at apex. Stylet slenderer than in *C. canis*.

27. Genus ARCHÆOPSYLLA Dampf, 1908

Genal comb composed of one to three, usually two spines. Eye present. Labial palpus reaching much beyond apex of third segment of maxillary palpus. Pronotal comb present, much reduced. Hind coxa with a patch of spinelets on inner surface. One antepygial bristle on each side.

71. ARCHÆOPSYLLA SINENSIS Jordan et Rothschild, 1911. Text figs. 122 and 123.

Genal comb either absent or small and pale. Head with internal incassation from antennal groove upwards.

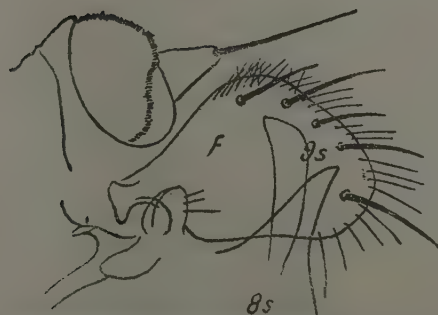


FIG. 122. *Archæopsylla sinensis*, male. (After Jordan and Rothschild.)

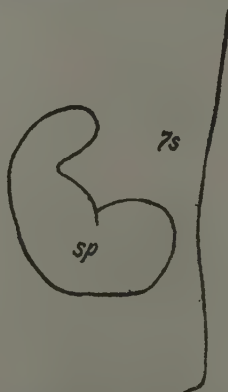


FIG. 123. *Archæopsylla sinensis*, female. (After Jordan and Rothschild.)

Male.—Ventral margin of 8s not denticulate. Manubrium long and narrow, apex slightly dilated and rounded. Finger very broad, apex gradually and slightly convex, ventral edge bearing a narrow membranous appendage. 9s small, lying within finger, anterior margin nearly straight, posterior margin strongly rounded near apical portion.

Female.—Apical margin of 7s straight, very slightly incurved near center. Apex of 8t more or less truncate. Spermatheca appearing 3-jointed, widest portion of head slightly less than twice width of tail.

28. Genus *XENOPSYLLA* Glinkewicz, 1907

Frontal tubercle wanting. Eye present. Labial palpus composed of four segments. Genal process almost completely closing antennal groove. Anterior angle of genal edge of head not produced into a triangular lobe. No comb on head. Club of antennæ short, distinctly segmented only on posterior side. Ocular row composed of two bristles, ocular bristle in front of eye. First and second occipital rows represented by one bristle or first row lacking. Pronotal comb lacking. Mesosternite with two sclerotized incassations extending from insertion of coxa forwards and upwards. Hind coxa with spinelets on inner side. Fifth tarsal segment with four lateral pairs of plantar bristles besides subapical hair.

Male.—Clasper without large flap present in *Pulex*. Manubrium narrow. Upper internal portion of 9s not very sharply defined.

Female.—Head of spermatheca globular, base of tail not sharply defined.

72. *XENOPSYLLA CHEOPIS* (Rothschild, 1903). Text figs. 124 to 126.

Labial palpus reaching to apex of fore coxa. Dorsal incassation of occiput with even contour. Episternum and sternum of metathorax separated by a vertical rodlike incassation. Longest apical bristle of second hind tarsal segment reaching to middle of fifth segment. Antepygidial bristle not on a conelike process.

Male.—Upper margin of clasper slightly convex, lower margin slightly concave. Fingers two; one narrow and

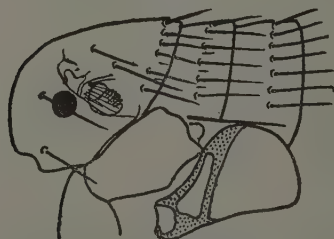


FIG. 124. *Xenopsylla cheopis*, female, head.
(After Rothschild.)

more or less straight, the other relatively broad and asymmetrical. Posterior arm of 9s club-shaped, gradually widening towards apex.

Female.—Stylet short. Head of spermatheca globular, tail long and strongly curved, wider at base than at head.

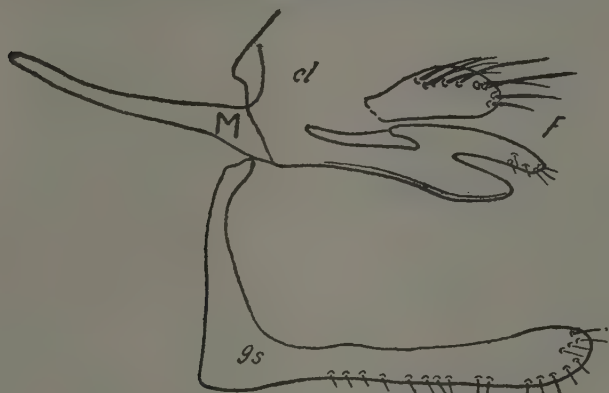


FIG. 125. *Xenopsylla cheopis*, male. (After Jordan and Rothschild.)

29. Genus PULEX Linnæus, 1758

Frontal tubercle absent. Eye present. Labial palpus 4-jointed. Club of antenna short, distinctly segmented only on posterior side. Antennal groove closed behind. Ocular bristle lower than eye. Except for an ocular row and an occipital apical row, there is no bristle on head. Mandibles broad, short, densely serrate. Pronotum without comb. Mesosternite very narrow, with but one oblique rodlike incrassation extending from insertion of coxa forward to lower anterior margin. Hind coxa with a patch of spinelets. Fifth

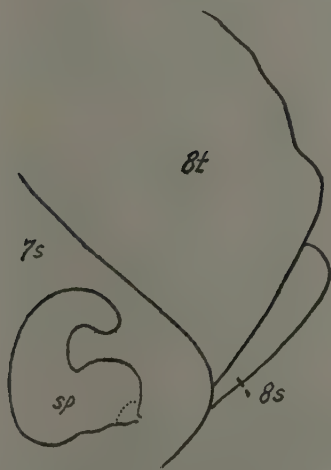


FIG. 126. *Xenopsylla cheopis*, female. (After Jordan and Rothschild.)

tarsal segment with four pairs of lateral plantar bristles. Only one antepygidial bristle on each side. Clasper of male with two fingers of pincerlike formation covered by a third process in form of a large hairy flap.

73. *PULEX IRRITANS* Linnaeus, 1758. Text figs. 127 to 129.

Eyes large. Labial palpus reaching to about half length of fore coxa. An ocular row of two bristles. Occiput with an

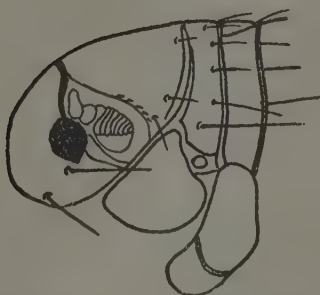


FIG. 127. *Pulex irritans*, male, head. (After Fox.)

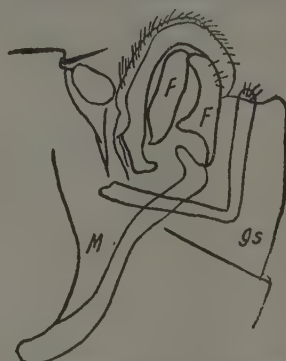


FIG. 128. *Pulex irritans*, male. (After Fox.)

apical row of three bristles. Hind femur with a lateral row of seven or more bristles on inside. Fifth hind tarsal segment longer than second.

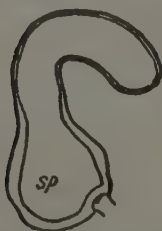


FIG. 129. *Pulex irritans*, female. (After Fox.)

Male.—Sensory plate very short. Two strongly sclerotized processes forming a pair of pincers on inside of large flap. Manubrium with a rounded apex. 9s consisting of two straight arms of nearly equal width.

Female.—Dorsal edge of 8t projecting above sensory plate. Spermatheca with globular head and slender tail of nearly equal width.

Family HECTOPSYLLIDÆ Baker, 1904

Head without genal comb. Eyes present. Vertical suture between bases of antennal grooves absent or rudimentary. Preoral flaps wanting. Thoracic segments strongly shortened, their tergites together shorter than first abdominal tergite. Pronotal comb absent. Abdomen without combs. Antepygidial bristles

absent. Clasper of male with two movable fingers. Abdomen of gravid female exceedingly distended, provided with only one seminal receptacle.

Key to the subfamilies of Hectopsyllidæ.

1. Hind coxa with a crowded patch of short spinelets on inside. Second and third abdominal segments provided with spiracles.

ECHIDNOPHAGINÆ.

- Hind coxa without a patch of spinelets. Second and third abdominal segments of female with vestigial spiracles or without spiracles.

SARCOPSYLLINÆ.

Subfamily ECHIDNOPHAGINÆ Wagner, 1927

Hind coxa with a thickly studded patch of short spinelets on inner surface. Second and third abdominal segments provided with a stigma.

30. Genus ECHIDNOPHAGA Oliff, 1886

Labial palpus 1-segmented. Head angulate in front, divided by a groove or an internal thickening from antennal groove upwards. Hind coxa anteriorly produced at apex into a broad tooth, bearing a patch of spinelets on inner side. Hind femur simple. Second to seventh abdominal segments with a stigma in both sexes. Anal segment of female with stylet.

74. ECHIDNOPHAGA GALLINACEA (Westwood, 1875). Text figs. 130 and 131.

Anterior margin of front vertical, forming obtuse angles above and below. Gena with a tooth which is rounded at apex.

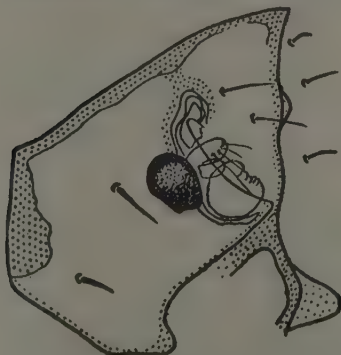


FIG. 130. *Echidnophaga gallinacea*, female, head.
(After Ioff and Argyropulo.)

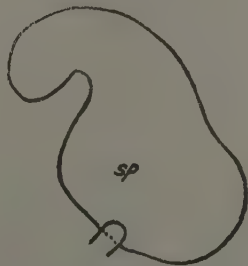


FIG. 131. *Echidnophaga gallinacea*, female.
(After Fox.)

Eyes larger, situated slightly near lower genal margin. Hind margin of head with a small lateral lobe, width of lobe considerably longer than length. Genal process more or less pointed

at apex, usually not projecting beyond hind margin of head. Apex of mandible reaching to one-third or one-half of length of fore femur. Fifth tarsal segment provided with four pairs of lateral plantar bristles (fourth pair less developed than three other pairs) and, in addition, two ventral apical plantar bristles.

Subfamily SARCOPSYLLINÆ Wagner, 1927

Hind coxa without a patch of short spinelets on inner surface. Abdominal stigmata much reduced in size, obliterated on second and third segments of female.

31. Genus *DERMATOPHILUS* Guerin, 1838

The absence of a patch of spinelets on the inside of the hind coxa and of the toothlike projection near the base of the hind femur suffice to distinguish *Dermatophilus* from the genera of the other two subfamilies. Other generic characters are as follows: Front produced into an angular tubercle along anterior margin. Labial palpus composed of one segment. Prosternite not produced posteriorly into a distinct conical tooth. Tibia with three pairs of dorsal bristles. Tarsi very slender, some of apical bristles on second, third, and fourth hind tarsal segments very long and thin; fifth tarsal segment linear, about eight times as long as broad, with a few long and thin hairs. Claws slender, without basal projection. Female without anal stylet and without stigma on second and third abdominal tergites.

75. *DERMATOPHILUS CÆCIGENA* (Jordan et Rothschild, 1921). Text fig. 132.



FIG. 132. *Dermatophilus cæcigena*, female, head. (After Jordan and Rothschild.)

Female.—Ovoid, tough-skinned, contracted posteriorly into a short, tail-like process which exhibits sclerotized structures at tip. Largest specimen 8.5 millimeters long and 6 millimeters broad. Head similar to that of *D. cæcata*, except that the genal edge is somewhat more rounded and the area between the antennal groove and mouth parts is of more even width. Fourth joint of maxillary palpus twice as long as second, and last two joints as wide as others. Anterior extremity of abdomen produced into four rounded lobes, which almost conceal minute head, thorax, and limbs of the insect.

TABLE 3.—*Mammalian hosts of Chinese fleas.*

[The arrangement of the orders is that adopted by Howell in Mammals from China in the Collections of the United States National Museum (1929).]

Host.	Flea.	Locality.
Order Insectivora.		
Family Erinacidae.		
<i>Erinaceus mitom.</i>	<i>Archaeopsylla sinensis</i> J. and R.	Shensi.
Family Talpidae.		
<i>Scaptochirus gilliesi</i>	<i>Reclfontia jaonis</i> (Jord.)	Do.
"Moile"	<i>Palaopsylla remota</i> Jord.	Szechwan.
Order Chiroptera.		
Family Rhinolophidae.		
<i>Rhinolophus ferrumequinum nuyton.</i>	<i>Ichnopsyllus neohamii</i> Hsu.	Soochow.
Family Vespertilionidae.		
<i>Nyctalus asiaticus.</i>	do.	Do.
<i>Pipistrellus abramus.</i>	do.	Do.
<i>Pipistrellus sp.</i>	<i>Mydopsylla trisetis</i> Jord.	Manchuria.
<i>Vesperugo planeti</i>	<i>Ichnopsyllus comans</i> J. and R.	Peiping.
"Bat"		
"Common house bat"	<i>Monopsyllus arvensis</i> (Roths.)	Hangchow.
Order Carnivora.		
Family Canidae.		
<i>Canis familiaris.</i>	<i>Nyctideropsylla galba</i> Dampf.	Shanghai.
	<i>Ichnopsyllus tsetschit</i> Sugimoto.	Hangchow.
Family Mustelidae.		
<i>Mustela sp.</i>	<i>Ctenocephalides canis</i> (Curtis)	China.
<i>Putorius sinensis.</i>	<i>Ctenocephalides felis</i> (Bouché)	Do.
	<i>Pulex irritans</i> Linn.	Do.
Family Felidae.		
<i>Putorius sp.</i>	<i>Ceratophyllus kaznakovi</i> Wagner	East Tibet.
	<i>Chelopsylla hangchowensis</i> Liu.	Hangchow.
<i>Felis domestica.</i>	<i>Ceratophyllus kaznakovi</i> Wagner	East Tibet.
	<i>Reclfontia ocola</i> Wagner	East Tibet.
	<i>Reclfontia vicina</i> Wagner	Tibet.
		Do.
	<i>Ctenocephalides canis</i> (Curtis)	China.
	<i>Ctenocephalides felis</i> (Bouché)	Do.
	<i>Pulex irritans</i> Linn.	Do.

TABLE 3.—*Mammalian hosts of Chinese fleas—Continued.*

Host.	Flea.	Locality.
Order Primates. Family Hominidae. <i>Homo sapiens</i>	<i>Ctenocephalides canis</i> (Curtis) <i>Pulex irritans</i> Linn.	China. Do.
Order Rodentia. Family Scuridae. <i>Citellus mongolicus</i> ?.....	<i>Ceratophyllus tesquorum mongolicus</i> J. and R. <i>Ceratophyllus tesquorum sungaris</i> Jord. <i>Neopsylla bidentatiformis</i> (Wagner) <i>Opthalmopsylla jettmari</i> Jord. <i>Opthalmopsylla kukuchikini</i> Ioff. <i>Oropsylla elana</i> Jord. <i>Dianomys mandarinus</i> (J. and R.) <i>Reckfrontia dives</i> (Jord.) <i>Aceratophyllus eutiles</i> (J. and R.) <i>Oropsylla stantiewi stantiewi</i> (Wagner)	Mongolia. Manchuria. Do. South Manchuria. Do. Do. Manchuria. Shensi. South Manchuria. Szechwan, Yunnan. Manchuria. Mongolia. Kansu. Do. Do. Szechwan, Yunnan. Szechwan. Do. Do. Chekiang.
 <i>Citellus dahuricus mongolicus</i> <i>Citellus</i> sp. <i>Dremomys pernyi</i> Griselda <i>Marmota bobac</i>	<i>Frontopsylla luculenta parilis</i> Jord. <i>Ceratophyllus dolabratus</i> (J. and R.) <i>Ceratophyllus tesquorum famulus</i> J. and R. <i>Oropsylla stantiewi crassus</i> (J. and R.)	 Mongolia. Do. Do. Do.
 <i>Marmota robusta</i>	<i>Aceratophyllus eutiles</i> (J. and R.) <i>Paraceras crispus</i> (J. and R.) <i>Stenoponia celestis</i> J. and R.	 Szechwan, Yunnan. Szechwan. Do.
<i>Sciardamias dardianus dardianus</i>	<i>Ceratophyllus phaeopsis</i> J. and R. <i>Necercatophyllus trispinosus</i> Liu	Do.
<i>Sciardamias dardianus consobrinus</i> <i>Sciurus</i> sp.	<i>Ceratophyllus tesquorum sungaris</i> Jord. <i>Frontopsylla luculenta parilis</i> Jord.	Manchuria. Mongolia.
<i>Spermophilus</i> sp. ? (burrow)..... <i>Tamias sibiricus</i>	<i>Aceratophyllus eutiles</i> (J. and R.)	Szechwan, Yunnan.

Family Cricetidae.	<i>Cricetulus campbelli</i>	<i>Oropsylla dana</i> Jordan.....	Manchuria.
	<i>Cricetulus arenarius</i>	<i>Ceradophyllus tesquorum singaria</i> Jordan.....	Do.
	<i>Cricetulus surunculus</i>	<i>Amphipsylla einogradovi</i> Ioff.....	Do.
		<i>Neopsylla bidentatiformis</i> (Wagner).....	Do.
	<i>Cricetulus griseus</i>	do.....	Do.
		<i>Recofrontia dives</i> (Jord.).....	South Manchuria.
	<i>Cricetulus griseus fumatus</i>	<i>Neopsylla bidentatiformis</i> (Wagner).....	Manchuria.
		<i>Ophthalmopsylla jeltmari</i> Jord.....	South Manchuria.
		<i>Ophthalmopsylla kukuchkini</i> Ioff.....	Do.
		<i>Ophthalmopsylla jeltmari</i> Jord.....	Do.
	<i>Cricetulus sp.</i>	<i>Recofrontia insolita</i> (Jord.).....	Do.
		<i>Recofrontia tenella</i> (Jord.).....	Manchuria.
	<i>Cricetulus trilon</i>	<i>Neopsylla bidentatiformis</i> (Wagner).....	Do.
		<i>Amphipsylla mitis</i> Jord.....	Mongolia.
	<i>Microtus ecomus</i>	<i>Frontopsylla luculentus paritis</i> Jord.....	Do.
		<i>Amphipsylla tata</i> Wagner.....	Tibet.
	<i>Microtus sp.</i>	<i>Ceradophyllus kozlovi</i> Wagner.....	East Tibet.
Family Spalacidae.		<i>Neopsylla anomia</i> Roths.....	Shensi.
	<i>Myospalax cansus</i>	<i>Amphipsylla castis</i> J. and R.....	Do.
		<i>Neopsylla aliena</i> J. and R.....	Do.
Family Muridae.	<i>Myospalax fontanieri</i>	<i>Genophthalmus yunnanus</i> Jord.....	Yunnan.
	<i>Apodemus agrarius</i>	<i>Neopsylla specialis</i> Jord.....	Do.
		<i>Frontopsylla spadix spadix</i> (J. and R.).....	Do.
	<i>Apodemus silevicius laborum</i>	<i>Dermatophyllus ercigena</i> (J. and R.).....	Ningpo, Shanghai, Soochow.
	<i>Mus decumanus</i>	<i>Ceradophyllus fasciatus</i> (Bose).....	Shanghai, Soochow.
		<i>Genopsylla segnis</i> (Schön.).....	China.
	<i>Mus musculus</i>	<i>Genopsylla cheopis</i> (Roths.).....	Canton, Hauchow, Peiping, Shanghai.
		<i>Amphipsylla aspalacis</i> Jord.....	Manchuria.
	<i>Myotapra aspalax</i>	<i>Recofrontia faunis</i> (Jord.).....	Do.
		<i>Paradoxopsyllus curvispinus</i> Miya. and Koid.....	Shensi.
	<i>Rattus confucianus laticolor</i>	<i>Neopsylla sinensis</i> Roths.....	Szechwan.
	<i>Rattus griseipectus</i>	<i>Ceradophyllus fasciatus</i> (Bose).....	Shanghai, Soochow.
		<i>Genopsyllus segnis</i> (Schön.).....	China.
	<i>Rattus norvegicus</i>	<i>Dermatophyllus ercigena</i> (J. and R.).....	Ningpo, Shanghai, Soochow.
		<i>Monopsyllus anisus</i> (Roths.).....	Hangchow, Hauchow, Manchuria, Peiping.
		<i>Xenopsylla cheopis</i> (Roths.).....	Canton, Hauchow, Peiping, Shanghai.

TABLE 3.—Mammalian hosts of Chinese fleas—Continued.

Host.	Flea.	Locality.
<i>Rattus norvegicus</i>	<i>Frontopsylla elatus botis</i> Jord.	South Manchuria.
<i>Rattus rattus</i>	<i>Pectinocentrus adatis</i> Jord.	Manchuria.
Family Zapodidae.	<i>Ctenopsyllus sogris</i> (Schöb.).....	China.
Family Dipodidae.	<i>Xenopsylla cheopis</i> (Roeth.).....	Canton, Hsuechow, Peiping, Shanghai.
<i>Alouatta mongolica</i>	<i>Ceratophyllus esquorum vngaris</i> (Jord.).....	Manchuria.
Rodentia of uncertain position.....	<i>Frontopsylla luculentus paritis</i> Jord.	Mongolia.
	<i>Ophthalmapsylla perfectus peritz</i> Wagner	Do.
	<i>Ophthalmapsylla kiritschenko</i> Wagner	Do.
Order Lagomorpha.		
Family Ochotonidae.		
<i>Ochotona alpina</i>	<i>Amphalius rufatus</i> (J. and R.).....	Manchuria, Mongolia.
	<i>Ceratophyllus eulata</i> (J. and R.).....	Szechwan, Yunnan.
<i>Ochotona cansa</i>	<i>Frontopsylla spatz cansa</i> Jord.	Do.
	<i>Geusidia borea</i> Jord.	Do.
<i>Ochotona cursoria</i>	<i>Amphalius clarus</i> (J. and R.).....	Tibet.
	<i>Ceratophyllus sparsitis</i> (J. and R.).....	Do.
	<i>Amphalius rufatus</i> (J. and R.).....	Manchuria, Mongolia.
	<i>Frontopsylla luculentus luculenta</i> (J. and R.).....	Manchuria.
<i>Ochotona dahurica</i>	<i>Frontopsylla luculentus paritis</i> Jord.	Mongolia.
	<i>Frontopsylla wagneri</i> Ioff	Do.
	<i>Neopsylla bidentatiformis</i> (Wagner).....	Manchuria.
	<i>Ophthalmapsylla perfectus peritz</i> Jord.	Mongolia.
<i>Ochotona thibetana</i>	<i>Plectronotia dahurica</i> (J. and R.).....	Manchuria.
	<i>Frontopsylla spatz cansa</i> Jord.	Szechwan.

Family Leporidae.			
<i>Lilobius tanceri</i>		<i>Ceratophyllus laticerpe ellibsi</i> Wagner.....	Mongolia.
<i>Oryzolagus cuniculus</i> var. <i>domesticus</i>		<i>Frontopsylla hetera</i> Wagner.....	Do.
Order Artiodactyla.		<i>Paradozopsyllus contemius</i> Wagner.....	Do.
Family Cervidae.		<i>Pulex irritans</i> Linn.	Hangchow.
<i>Capreolus bedfordi</i>			
<i>Callascirtus erythreus glorient</i>		<i>Vermipsylla doreadia</i> Roths.	Shensi.
<i>Dignus socerbyi</i>		<i>Aceratophyllus euteles</i> (R. and R.).....	Szechwan, Yunnan.
Family Bovidae.		<i>Neopsylla compar</i> J. and R.	Shensi.
<i>Antelionys custos</i>		<i>Ctenophthalmus dinornis</i> Jord.	Szechwan.
		<i>Ctenophthalmus parvus</i> Jord.	Do.
<i>Eolthenomys prodictor</i>		<i>Neopsylla steneasi</i> Roths.	Do.
<i>Gazella subgutturosa</i>		<i>Paradozopsyllus custodia</i> Jord.	Do.
<i>Ovis arisa</i>		<i>Stenischia mirabilis</i> Jord.	Do.
Unknown mammal		<i>Neopsylla honora</i> Jori.	Yunnan.
Host not given		<i>Vermipsylla doreadia</i> Roths.	Shensi.
		<i>Ctenocephalides canis</i> (Curtis).....	Hangchow.
		<i>Parucerus sinensis</i> (Liu)	Szechwan.
		<i>Ceratophyllus gallinae</i> (Sehrank).....	Mongolia.
		<i>Echthophaga gallinacea</i> (Westw.).....	Shanghai.

BIBLIOGRAPHY

[Starred references deal with fleas of China.]

1. BACOT, A. W. A study of the bionomics of the common rat fleas and other species associated with human habitations, with special reference to the influence of temperature and humidity at various periods of the life history of the insect. *Journ. Hyg.* 8 Plague Suppl. 3 (1914) 447-654.
2. BACOT, A. W., and C. J. MARTIN. Observations on the mechanism of the transmission of plague by fleas. *Journ. Hyg.* 8 Plague Suppl. 3 (1914) 423-438.
3. BACOT, A. W., and W. G. RIDEWOOD. Observations on the larvæ of fleas. *Parasitol.* 7 (1914) 157-175.
4. BAKER, C. F. A revision of the American Siphonaptera. *Proc. U. S. Nat. Mus.* 27 (1904) 365-469.
5. BAKER, C. F. The classification of the American Siphonaptera. *Proc. U. S. Nat. Mus.* 29 (1905) 121-170.
6. BEDFORD, G. A. H. A synoptic check-list and host-list of the ectoparasites found on South African Mammalia, Aves and Reptilia. 2d ed. *Rept. Vet. Res. S. Afr.* 18 (1932) 429-462.
- *7. BLANDFORD, W. F. H. The chigoe in Asia. *Ent. Mon. Mag.* 30 (1894) 228-230.
8. BUXTON, P. A. Siphonaptera. *Insects of Samoa.* *Brit. Mus.* 7 fasc. 2 (1928) 53, 54.
9. BUXTON, P. A. Studies on the biology of fleas. *London Naturalist* 1931 (1932) 39-42.
10. CHAPIN, E. A. New species of North American Siphonaptera. *Bull. Brooklyn Ent. Soc.* 14 (1919) 49-62.
11. CHAPIN, E. A. Remarks on the genus *Hystriehopsylla* Tasch. with description of a new species. *Proc. Ent. Soc. Wash.* 23 (1921) 25-27.
- *12. CHEN, H. T., and W. A. RILEY. Notes on fleas of Canton China rats. *Lingnan Sci. Journ.* 11 (1932) 445-448.
13. CRAGG, F. W. The distribution of the Indian species of the genus *Xenopsylla*, with reference to the immunity of certain areas from plague epidemics. *Ind. Journ. Med. Res. Spec. Ind. Sc. Congress* (1920) 29-34.
14. DALLA TORRE, C. G. *Aphaniptera orbis terrarum* (synopsis praeursoria). *Ber. naturw. med. Ver. Innsbruck* 39 (1924) 1-29.
15. DAMPF, A. Eine neue *Nycteridopsylla* aus Shanghai. *Zool. Anz.* 36 (1910) 11-15.
16. DAMPF, A. Eine neue *Aphanipteren*-Art (*Ischnopsyllus dolosus*, sp. nov.) aus dem Kaukasus. *Revue Russ. Ent.* 12 (1912) 41-59.
17. DUNN, L. H., and R. R. PARKER. Fleas found on wild animals in the Bitterroot Valley, Montana. *U. S. Pub. Health Rept.* 38 (1923) 2763-2775.
18. EWING, H. E. Notes on the taxonomy and natural relationships of fleas, with descriptions of four new species. *Parasitol.* 16 (1924) 341-354.
19. EWING, H. E. A collection of fleas from the Island of Hawaii. *Proc. Ent. Soc. Wash.* 26 (1924) 209, 210.

20. EWING, H. E. A new flea from Alaska. *Proc. Biol. Soc. Wash.* 40 (1927) 89, 90.
21. EWING, H. E. Notes on the siphonapteran genus *Catallagia* Roths. including the description of a new species. *Proc. Biol. Soc. Wash.* 42 (1929) 125-128.
22. EWING, H. E. A Manual of External Parasites (1929) 153-203.
23. EWING, H. E. Some factors affecting the distribution of and variation in North American ectoparasites. *American Naturalist* 65 (1931) 360-369.
24. FOX, C. The taxonomic value of the copulatory organs of the females in the order Siphonaptera. *U. S. Pub. Health Serv. Hyg. Lab. Bull.* 97 (1914) 19-22.
25. FOX, C. Insects and disease of man (1925) 112-142.
26. FOX, C. Some new Siphonaptera from California. *Pan Pacific Ent.* 2 (1926) 182-185.
27. FOX, C. Some new Siphonaptera. *Trans. Amer. Ent. Soc.* 53 (1927) 209-212.
28. GOLOV, D., and I. IOFF. Puces de Spermphiles porteuses de l'infection pesteuse durant l'hiver. *Rev. Microb. Epid.* 5 (1926) 239-251.
29. HENDERSON, J. R. A note on some external characters of larvæ of *Xenopsylla cheopis*. *Parasitol.* 20 (1928) 115-118.
- *30. HERTIG, M., and T. F. HUANG. A rat-flea survey of Peking. *Amer. Journ. Trop. Med.* 10 (1929) 521-525.
31. HICKS, E. P. The relation of rat fleas to plague in Shanghai. *Journ. Hyg.* 26 (1927) 163-169.
32. HOWELL, A. B. Mammals from China in the collections of the U. S. National Museum. *Proc. U. S. Nat. Mus.* 75 (1929) 1-82.
- *33. HSÜ, Y. C. Two new species of insect parasites of the bat in Soochow. *Peking Nat. Hist. Bull.* 9 (1935) 293-298.
- *34. HSÜ, Y. C. A second new species of bat flea from Soochow. *Peking Nat. Hist. Bull.* 10 (1936) 137-139.
35. INGRAM, A. New fleas from South African rodents. *Bull. Ent. Res.* 17 (1927) 289-293.
36. INGRAM, A. Three new South African *Xenopsylla*. *Bull. Ent. Res.* 18 (1928) 371-375.
37. IOFF, I. Über neue Aphanipteren in der Sammlung des zoologischen Museums der Akademie der Wissenschaften. *Ann. Mus. Zool. Acad. Sci. USSR* 28 (1927) 407-439.
38. IOFF, I. Materialien zum Studium der Ektoparasitenfauna im S.-O. Russlands. IV, Flöhe der Murmeltiere (*Marmota*) und der Gelbziesel (*Citellus fulvus*), *Rev. Microbiol. Epidémiol.* 6 (1927) 316-323; V, Flöhe der Springmäuse (*Dipodidae*); VI, Flöhe der Blindmäuse (*Spalacidae*); VII, Die Flöhe der Steppeniltisse. *Ber. Mikrob. Staats-Inst. Rostow am Don* No. 8 (1929) 60 pp.; VIII, Flöhe der *Ellobius talpinus*, *Rev. Microb. Epidémiol.* 14 (1935) 79-86.
39. IOFF, I. Zur Systematik und Oekologie der Flöhe der Springmäuse (*Dipodidae*). *Zoöl. Jahrb.* 58 (1929) 359-388.
40. IOFF, I. Über *Xenopsylla conformis* W. und einige verwandte Aphaniptera-Arten. *Zool. Anz.* 92 (1930) 191-206.

41. IOFF, I. Flöhe Russlands, insbesondere der Gattungen *Stenoponia* J. et R., *Coptosylla* J. et R. und *Chaetopsylla* Koh. Zeit. Parasitenkunde 7 (1934) 363-391.
42. IOFF, I. Über die Geographie der Ziesel-flöhe im Zusammenhang mit der Geschichte der Ausbreitung der Ziesel. Mag. Parasit. Inst. Zool. Acad. des Sci. USSR 6 (1936) 313-361.
43. IOFF, I. Zur Systematik der Flöhe aus der Unterfamilie Ceratophyllinae. Zeit. für Parasitenkunde 9 (1936) 73-124.
44. IOFF, I., und A. ARGYROPULO. Die Flöhe Armeniens. Zeit. für Parasitenkunde 7 (1934) 138-166.
45. IOFF, I., und N. EFREMOVA. Zur Frage über Fauna und Biologie der Flöhe an Haustieren in Mittelasien. Meditsinskaya Mysl' Uzebekistana (4) 4 (1927) 1-10.
46. IOFF, I., und V. TIFLOV. Zur Fauna und Oekologie der Flöhe der Waldsteppen. Mag. Parasit. 1 (1930) 193-227.
47. JORDAN, K. On *Xenopsylla* and allied genera of Siphonaptera. Intern. Ent.-Kongr. Zürich 1925 2 (1926) 593-627.
48. JORDAN, K. Siphonaptera collected during a visit to the Eastern U. S. of North America in 1927. Nov. Zool. 34 (1928) 178-188.
49. JORDAN, K. On some problems of distribution, variability and variation in North American Siphonaptera. 4th Intern. Congr. Ent. Ithaca 2 (1928) 489-499.
50. JORDAN, K. Notes on North American fleas. Nov. Zool. 35 (1929) 28-39.
51. JORDAN, K. On a small collection of Siphonaptera from the Adirondacks with a list of the species known from the state of New York. Nov. Zool. 35 (1929) 168-177.
52. JORDAN, K. Some new Palearctic fleas. Nov. Zool. 35 (1929) 178-186.
- *53. JORDAN, K. Some Old-World Siphonaptera. Nov. Zool. 35 (1929) 40, 41.
54. JORDAN, K. On fleas collected by Dr. H. M. Jettmar in Mongolia and Manchuria in 1927 and 1928. Nov. Zool. 35 (1929) 155-164.
55. JORDAN, K. Three new Old World fleas. Nov. Zool. 35 (1931) 144-147.
56. JORDAN, K. Three new species of *Neopsylla* from the Oriental Region. Nov. Zool. 36 (1931) 220-224.
57. JORDAN, K. New Oriental fleas. Nov. Zool. 38 (1932) 267-275.
58. JORDAN, K. Notes on Siphonaptera. Nov. Zool. 38 (1932) 291-294.
- *59. JORDAN, K. Siphonaptera collected by Harold Stevens on the Kelley-Roosevelt Expedition in Yunnan and Szechuan. Nov. Zool. 38 (1932) 276-290.
60. JORDAN, K. A survey of the classification of the American species of *Ceratophyllus* s. lat. Nov. Zool. 39 (1933) 70-79.
61. JORDAN, K., and N. C. ROTHSCHILD. A revision of the Sarcopsyllidae, a family of Siphonaptera. Thompson-Yates Lab. Rep. N. Ser. 7 (1906) 15-72.
62. JORDAN, K., and N. C. ROTHSCHILD. Some new Siphonaptera from China. Proc. Zool. Soc. London (1911) 365-392.

63. JORDAN, K., and N. C. ROTHSCILD. Katalog der Siphonapteren des königlichen Museums in Berlin. Nov. Zool. 18 (1911) 57-89.
64. JORDAN, K., and N. C. ROTHSCILD. On Siphonaptera collected in Algeria. Nov. Zool. 19 (1912) 357-372.
65. JORDAN, K., and N. C. ROTHSCILD. Siphonaptera collected by Mr. Robin Kemp in tropical Africa. Nov. Zool. 20 (1913) 528-581.
66. JORDAN, K., and N. C. ROTHSCILD. On some Siphonaptera collected by W. Rückbell in East Turkestan. Ectop. 1 (1915) 1-24.
67. JORDAN, K., and N. C. ROTHSCILD. On Ceratophyllus fasciatus and some allied Indian species of fleas. Ectop. 1 (1921) 178-198.
68. JORDAN, K., and N. C. ROTHSCILD. Eight new Ceratophylli. Ectop. 1 (1921) 163-177.
69. JORDAN, K., and N. C. ROTHSCILD. A new species of Sarcopsyllidæ. Ectop. 1 (1921) 131-132.
- *70. JORDAN, K., and N. C. ROTHSCILD. New genera and species of bat fleas. Ectop. 1 (1921) 142-162.
- *71. JORDAN, K., and N. C. ROTHSCILD. New Siphonaptera. Ectop. 1 (1922) 266-283.
- *72. JORDAN, K., and N. C. ROTHSCILD. On some Siphonaptera from the Eastern Hemisphere. Ectop. 1 (1923) 293-308.
73. KOPSTEIN, F. Die Oekologie der javanischen Siphonapteren und ihre Bedeutung für die Epidemiologie der Pest. Z. Morph. Oekol. Tiere 24 (1932) 408-434.
74. LESSON, H. S. Methods of rearing and maintaining large stocks of fleas and mosquitoes for experimental purposes. Bull. Ent. Res. 23 (1932) 25-31.
75. LIU, C. Y. Catalogue of Chinese Synoptera. Lingnan Sci. Journ. 15 (1936) 379-390, 583-594.
- *76. LIU, C. Y. On the unrecorded male of the bat flea, Ischnopsyllus taishii Sugimoto. China Journ. Arts and Sci. 23 (1935) 306-310.
77. LIU, C. Y. A new Chinese flea. Peking Nat. Hist. Bull. 9 (1935) 273-275.
78. LUNDBLAD, O. Zur Kenntnis der Flöhe. Zool. Anz. 70 (1927) 7-26.
79. MIYAJIMA, M., and M. KOIDSUMI. On the study of the Japanese rat fleas. Journ. Bact. (1909) 1-46.
80. NEGISHI, H. Statistical observations on rats bearing Echidnophaga gallinacea Westw. in the city of Kobe. Oyo-Dobuts. Zasshi 6 (1934) 17-33.
81. OHMORI, N. On the fleas of Formosa. Oyo-Dobuts. Zasshi 8 (1936) 158-164.
82. OUDEMANS, A. C. Aanteekeningen over Suctoria v. 'sGravenhage. Ber. Ent. Ned. 2 (1906) 131-134.
83. OUDEMANS, A. C. Neue Ansichten über die Morphologie des Flohkopfes, sowie über die Ontogenie, Phylogenie und Systematik der Flöhe. Nov. Zool. 16 (1910) 133-158.
84. PATTON, W. S., and F. W. CRAGG. A textbook of Medical Entomology (1913) 434-477.
85. PERFILJEW, P. Zur Anatomie der Flohlarven. Rev. Microbiol. Epidémiol. 6 (1927) 329-341.

- *86. RILEY, W. A. The ear chigoe of rats in China, *Tunga caecigena* J. and R. Lingnan Sci. Journ. 11 (1932) 285-287.
87. ROTHSCHILD, M. Siphonaptera from western Australia. Nov. Zool. 40 (1936) 3-16.
88. ROTHSCHILD, N. C. Casual notes on fleas. Nov. Zool. 2 (1895) 66.
89. ROTHSCHILD, N. C. Contributions to the knowledge of the Siphonaptera. Nov. Zool. 5 (1898) 533-544.
90. ROTHSCHILD, N. C. Further contributions to the knowledge of the Siphonaptera. Nov. Zool. 10 (1903) 317-325.
91. ROTHSCHILD, N. C. Further contributions to the knowledge of the Siphonaptera. Nov. Zool. 11 (1904) 602-653.
92. ROTHSCHILD, N. C. Note on the species of fleas found upon rats, *Mus rattus* and *Mus decumanus*, in different parts of the world, and on some variations in the proportion of each species in different localities. Journ. Hyg. 6 (1906) 483-485.
93. ROTHSCHILD, N. C. The physiological anatomy of the mouth parts and alimentary canal of the Indian rat flea, *Pulex cheopis* Rothschild. Journ. Hyg. 6 (1906) 486-495.
94. ROTHSCHILD, N. C. On some American, Australian and Palearctic Siphonaptera. Nov. Zool. 16 (1909) 61-68.
95. ROTHSCHILD, N. C. Synopsis of fleas found on rats and mice. Bull. Ent. Res. 1 (1910) 89-98.
96. ROTHSCHILD, N. C. On the bat-fleas described by Kolenati. Nov. Zool. 18 (1911) 48-56.
97. ROTHSCHILD, N. C. Some new genera and species of Siphonaptera. Nov. Zool. 18 (1911) 117-122.
- *98. ROTHSCHILD, N. C. Report on a small collection of fleas from India and China. Rec. Ind. Mus. 6 (1911) 43, 44.
- *99. ROTHSCHILD, N. C. Description of three new species of Siphonaptera, in Clark, R. S. and A. de C. Sowerby's "through Shen Kan." Appendix IV (1912) 194-203.
100. ROTHSCHILD, N. C. On *Neopsylla* and some allied genera of Siphonaptera. Ectop. 1 (1915) 30-44.
101. ROTHSCHILD, N. C. Contribution to our knowledge of the Siphonaptera *fracticipita*. Nov. Zool. 22 (1915) 302-308.
102. ROTHSCHILD, N. C. A synopsis of the British Siphonaptera. Ent. Mon. Mag. (3) 1 (1915) 49-112.
103. ROUBAUD, E. Une nouvelle espèce de puce-chique pénétrante, parasite des rats en Chine: *Dermatophilus lagrangei* n. sp. Bull. Soc. Path. Exotique 18 (1925) 399-403.
104. SHARIF, M. A revision of the Indian Siphonaptera. I. Family Pulicidae. Rec. Ind. Mus. 32 (1930) 29-62.
105. SIKES, E. K. Larvæ of *Ceratophyllus wickhami* and other species of fleas. Parasitol. 22 (1930) 242-259.
106. STILES, C. W., and B. J. COLLINS. *Ctenocephalides*, a new genus of fleas, type *Pulex canis*. U. S. Pub. Health Rept. 45 (1930) 1308-1310.
107. SUGIMOTO, M. Notes on fleas in Formosa. Trans. Nat. Hist. Soc. Formosa 23 (1933) 116-145.

108. TASCHENBERG, O. Die Flöhe. Halle (1880).
109. TIFLOV, V. E. Contribution à l'étude des aphanipteres du gouvernement de Saratov. Comptes Rendus du Premier Congrès Antipesteux de l' USSR (1927) 268-275.
110. TIFLOV, V. E., and E. I. PAVLOV. Materials for the study of the Transbaikalian flea fauna. Rev. Microbiol. 15 (1936) 79-88.
111. WAGNER, J. Zur Frage über den Kopfbau der Aphanipteren mit Berücksichtigung ihrer Systematik. Zool. Anz. 67 (1926) 289-292.
112. WAGNER, J. Über die Einteilung der Gattung Ceratophyllus Curtis. Konowia 6 (1927) 101-113.
113. WAGNER, J. Zur Benennung Ctenopsyllus Kolenati. Konowia 6 (1927) 287-290.
114. WAGNER, J. Über die nordamerikanische Ceratophylli welche auf Ziesel und Murmeltieren leben. Konowia 8 (1929) 311-315.
115. WAGNER, J. Über neue palaearktische Floh-Arten (Aphaniptera). I, Ann. Mus. Zool. Acad. Sci. USSR 30 (1929) 21-33; II, ibid., 531-547.
116. WAGNER, J. Katalog der palaearktischen Aphanipteren. Wien (1930) 55.
117. WAGNER, J. Zur Morphologie der letzten Abdominalsegmente der Flöhe. Zool. Jahrb. 56 (1932) 54-120.
118. WAGNER, J. Fünf neue palaearktische Flöhe. Konowia 11 (1932) 273-280.
119. WAGNER, J. Aphanipterologische Notizen, II. Eine Erklärung der Eigentümlichkeiten im Baue des 8. abdominalen Sternits bei Ceratophyllinen-Männchen. Konowia 12 (1933) 51-54.
120. WAGNER, J. Concerning Jordan's Notes on Siphonaptera. Konowia 12 (1933) 89-94.
121. WAGNER, J. Zweiter Nachtrag zum Kataloge der palaearktischen Aphanipteren, 1930. Konowia 12 (1933) 212-216.
122. WAGNER, J. Nachtrag zur Kenntnis der letzten Abdominalsegmente der Flöhe. Zool. Jahrb. 57 (1933) 365-374.
123. WAGNER, J. Weitere Einteilung der Gattung Ceratophyllus Curtis. Konowia 13 (1934) 260-263.
124. WAGNER, J. Dritter Nachtrag zum Kataloge der palaearktischen Aphanipteren, 1930. Konowia 14 (1935) 217-224.
125. WAGNER, J. Aphanipterologische Notizen, IV. Über das Reduzieren des 8. Abdominalsternits bei den Männchen einer Ceratophyllinengruppe. Konowia 14 (1936) 85-96.
126. WAGNER, J. Flöhe, Aphaniptera (Siphonaptera, Suctoria). Tierwelt Mitteleur. VI. Pt. 3. 2. Lief. (1936) xvii + 24 pp.
127. WAGNER, J., and A. ARGYROPOULO. Aphanipterenfauna des Aserbeidshans nebst Bemerkungen über die Gattung Nosopsyllus Jord. Zeit. Parasitenkunde 7 (1934) 217-232.
128. WAGNER, J., and A. VASSILIEFF. Tableaux analytiques pour la détermination des puces rencontrées en Algérie et Tunisie. Arch. Inst. Pasteur Tunis 21 (1933) 431-467.

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